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ABSTRACT

Empirical behavior principles were applied to the development of remedial teaching procedures and materials for retarded and emotionally disturbed students ages 5-8. Students were referred by schools as severe behavior problems or extreme learning disability cases; intelligence ranged from retarded to normal. Research, conducted in two laboratory classrooms, involved the individual-organism design in which each child served as his own control. Research on preparing programed instructional materials resulted in individualized programs in beginning reading, arithmetic, writing, spelling, and language. Research on procedures included development of individual pupil assessment techniques, a structure for the class day, techniques for modifying social-emotional behavior in the classroom, procedures for training the teacher's assistant and parents, and analysis of associated theoretical and methodological problems. Conclusions were that handicapped children can make academic and personal-emotional-social progress in such special classes at the primary level; that teacher aides are necessary to help with individualized instruction; that the teacher training curriculum needs to include behavioral technology; and that, with modifications, findings can be incorporated into public school special classes. (KW)

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Final Report

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APPLICATION OF BEHAVIORAL PRINCIPLES TO THE REMEDIAL INSTRUCTION OF RETARDED AND EMOTIONALLY DISTURBED YOUNG CHILDREN

August 1971

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Abstract

In this research, empirical behavior principles were applied to the development of procedures and materials for the remedial education of young retarded and emotionally disturbed school children. The specific objectives were to (1) work out a structure of the class day, (2) prepare programmed instructional materials (cognitive subjects), (3) delineate individual pupil assessment procedures for the teacher, (4) explicate the use of behavior modification techniques for social-emotional behavior in the classroom, (5) articulate general procedures for training the teacher's assistant and parents, and (6) analyze associated theoretical and methodological problems.

The research was conducted in two Laboratory classrooms for handicapped children. The children, ranging in age from five to eight, and in intelligence from retarded to normal, were referred by schools in Champaign and Urbana, Illinois. They were viewed as severe behavior problems or extreme learning disability cases neither of which the public school felt equipped to handle. The research method was the individual-organism design in which each child served as his own control. The settings for the research were the classroom, play yard, and home. Most of the individual studies extended over a period of months.

The research on producing materials resulted in individualized programs in beginning reading, arithmetic, writing, spelling, and language, each with detailed instructions for classroom personnel. The reading program, for obvious reasons, was given highest priority and is consequently the best developed of all the programs. All the programs were functional in helping the children to progress academically but all of the sequences still require refinements and extensions before they can be used more generally.

The research on procedures included the development of assessment techniques. These methods, designed primarily for the teacher, include evaluation of the child on admission to the class, his daily progress in all subjects, and his year-end status.

The research on procedures, furthermore, dealt with formulating a structure of the class day, modifying problem behavior in the classroom, training the teacher's assistant, and training a parent to help her child with his school work. Specific problems (e.g., the withdrawal of contrived reinforcers) were studied by informal and formal methods in the classroom and home, and findings were incorporated in the tentative guidelines. Systematic revisions of the structure of the class day resulted in a format that was flexible and functional for individualizing instruction and for fostering individual growth patterns.

A number of contributions to developmental theory and research methodology were prepared for publication.

Final Report

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APPLICATION OF BEHAVIORAL PRINCIPLES TO THE REMEDIAL INSTRUCTION OF RETARDED AND EMOTIONALLY DISTURBED YOUNG CHILDREN

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Urbana, Illinois

August 1971

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Education for the Handicapped

Preface

For many years, about 75 in fact, enormous amounts of time, energy, and money have been expended on problems associated with the early education of the retarded and emotionally disturbed child. Unfortunately, the outcome of these efforts has been less than gratifying. Recent surveys have shown that special classes for the handicapped child have been no more effective than the regular elementary classes. Johnson (1962), discussing the problem, stated pointedly that special classes have failed because special education teachers have devoted themselves to matters other than that which is their main mission - teaching academic skills.

> During the past three decades the general orientation of teacher preparation programs for the mentally handicapped has been (a) an emphasis upon disability rather than ability, and (b) the necessity for establishing a "good" mental hygiene situation for the children where they can develop into emotionally healthy individuals. Thus, the pressures for learning and achievement have been largely removed so that the child has no need to progress (p. 68).

Casual observation and discussions with special education teachers bear out the contention that there is indeed too little attention given to teaching tool subjects, the justification for this practice seeming to be based on a hiatus between teaching and learning, and traditional and modern concepts of intelligence and retardation.

Recently the art of teaching and the science of learning have given rise to a technology of teaching (Skinner, 1968), and intelligence and retardation have been analyzed as behavioral deficits resulting from biological, physical, and social restrictions in opportunities for development (Bijou, 1966). From this confluence have come studies on educational procedures for the institutionalized, retarded child (e.g., Bijou, Birnbrauer, Kidder, & Tague, 1966), on treatment techniques for the emotionally disturbed youngster (e.g., Wolf, Risley, & Mees, 1964), and on the remedial education of the retarded preschool child (Bijou, 1968a). Findings from these studies and others conducted in the same spirit have provided the underpinnings for the research reported here on the behavior technology for teaching the young handicapped school child.

This undertaking required the cooperative efforts of many people. We express our gratitude to the following: Project Directors, Jeffrey A. Grimm and Thomas E. Sajwaj; Teacher Supervisors, Mary Grace Meier and Susan F. Moore; Research Teachers, Linda S. Berner, Janet C. Gilmore, Alice C. Marshall, M. Jean Vansickle, and Sandra L. Twardosz; Child-Care Workers: Sherry Harlan and Terry McClelland; Graduate Assistants: Marion Ault, Joseph A. Parsons, Ely Rayek Zaga, and Barbara Wilcox; and the undergraduate and graduate students who have served as observers, tutors, teacher's assistants, and co-investigators.

We are particularly indebted to the secretary of the Child Behavior Laboratory. There are secretaries and there is Mrs. Dorothy M. Whalen who coordinated the budget with the detailed, day-to-day operation of the project and managed the logistics involved in typing and assembling the final draft of this report.

The preparation of this report would have been an overwhelming task had it not been for the conscientious and dedicated staff of the Child Behavior Laboratory. We wish particularly to thank Jeffrey A. Grimm for his supervision of the work of the staff, and the following for their substantial contributions:

Reading Program - Jeffrey A. Grimm

Arithmetic Program - Joseph A. Parsons and Jeffrey A. Grimm

Writing Program - Barbara Wilcox

Spelling Program - Linda S. Berner and Jeffrey A. Grimm

Language Program - Joseph A. Parsons and Janet C. Gilmore

Behavioral Assessment - Jeffrey A. Grimm

Educational History of a Child - Barbara Wilcox

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1. Introduction

This research is concerned with fabricating a technology for teaching of young handicapped children. It rests upon and extends previous research on the application of behavior principles (Bijou & Baer, 1961 & 1965; Skinner, 1953 & 1968) to the remedial education of institutionalized retarded children (e.g., Bijou, Birnbrauer, Kidder, & Tague, 1966), and to the preschool education of handicapped children (Bijou, 1968). These two studies were, in turn, inspired by the results of a series of investigations applying behavior principles to the treatment of children diagnosed as retarded, emotionally disturbed, autistic, and minimally brain-damaged (e.g., Wolf, Risley, & Mees, 1964; Johnston, Sloane, & Bijou, 1966).

The aims of the present research relate to the essential components of a technology of teaching. Specifically, they are:

1. To structure a class day that will augment learning and contribute to making the classroom culture a happy situation.

2. To refine and extend instructional materials (programs, books, workbooks, etc.), equipment, and procedures for learning reading, arithmetic, writing, spelling, and language (the cognitive behaviors) so that each child can always work at his level of competence and progress at his own rate under conditions of positive motivation.

3. To establish procedures that will enable a teacher to evaluate and monitor each pupil's progress.

4. To tailor behavior modification procedures to the special class so as to enhance social adjustment and learning skills (the social-emotional behaviors).

5. To develop procedures for the training of teacher assistants and parents.

6. To analyze some of the theoretical, methodological, and technological problems associated with the application of behavior principles to special teaching.

2. Research Design and Strategy

Data for the development of a technology of teaching young retarded and emotionally handicapped children are derived from precise observations of the behavior of each child in the classroom, playground, laboratory, or home. This approach, often referred to as the individual-organism design (each child observed serves as his own control), is relatively new in educational and training research and promises to provide meaningful information about the conditions which facilitate or hamper a child's learning efforts. Because of the potential of this approach, part of the research was devoted to adapting, extending, and refining the individual-organism design to studies with young children, particularly in natural settings.

From the point of view of the methodology followed here, research on the behavioral technology for the remedial teaching of young mentally handicapped school children should take place in the classroom and should be the cooperative effort of a special teacher and an expert in the application of behavior principles. The teacher should be knowledgeable in applied behavioral analysis (e.g., she should understand the significance of positive consequences for establishing and maintaining academic and social behavior), the teaching situation should be in a special classroom similar to that in a community school, and the pupils, those who have been clearly identified as mentally and emotionally handicapped. Under these circumstances, the research investigator can, and must, explore and evaluate every condition that comprises the school environment: number of hours in the school day, the sequence of activities in the daily program, the materials that make up the curriculum, the equipment used to facilitate learning, and, by far the most important, the behavior of the teacher in relation to the materials, the children, the parents, and the assistants. These requirements cannot yet be fulfilled in special classes in community schools or residential institutions.

Information on the preparation of materials and teaching procedures is derived from three sources: (1) data from systematic modification of specific teaching practices and conditions, and changes in the behavior of individual children, (2) data from monitoring the progress of each child in the academic tool subjects, and (3) data from formal descriptive and experimental field studies on individual children. The data from one source often influences the research in the others. For example, varying recess time during the morning may lead to a formal study on the effect of recess time on academic performance; or the results of a formal study on the effects of contingency management on the learning of arithmetic may lead to changes in procedures in teaching arithmetic and in monitoring a child's daily progress; or the analysis of daily progress charts in reading may lead to a formal study on correcting errors.

3. Description of the Children

In the first and second years of this project (1968-70), one of the two laboratory classes was made up of mentally handicapped children of preschool age, the other of mentally handicapped children of kindergarten and elementary school age. In the third year (1970-71), both classes were composed of mentally handicapped children of kindergarten and elementary school age. The change from younger to older age-groups was deliberate. The results of the first two years' work strongly indicated that our contribution to special education could be best achieved by applying behavior principles to the teaching of young children although eligible to attend school, had been already identified as mentally handicapped or as being serious classroom problems and thus either not being admitted or being expelled at the very beginning of their school careers. It became obvious that the research could then be oriented entirely toward developing procedures and materials that could be used in special classes.

The results of the work with preschool children studied during the first years not only pointed out the advantages of concentrating research efforts on young school-age children but they also provided the leads for effective techniques in working with and training parents, and for developing teaching techniques for improving children's social behavior and preacademic skills.

The children enrolled in both classes this past year (1970-71) were those having the most serious problem behaviors in the Urbana and Champaign school districts. Seven were from kindergarten classes, three were from first grades, one was from second grade, one was from fourth grade, one from the University Laboratory school, one from an educable retarded class, and one was not attending school. All were between 5 and 8 years old, and were described as retarded, emotionally disturbed, or both. In terms of the Peabody Picture Vocabulary Test, they ranged in mental age from 3 years 7 months to 7 years 10 months with a mean of 5 years 3 months, and in IQ from 59 to 108 with a mean of 82. On the Wide Range Achievement Test, their median score in reading was at the beginning of first grade (1.2), and their median score in arithmetic was at the end of kindergarten (Kg.9). In terms of behavior, they constituted two groups: those who were so disruptive that the school authorities had refused to keep them in school, and those who had been in school for six or more months and had made no observable progress, according to the teacher and school psychologists. Here are some examples:

A six-year-old girl. She flatly says "No" to almost everything that is asked of her, and teases the teacher by doing what she has been forbidden to do when she is sure the teacher is watching her. She does not interact with other children, but does play with some toys. She has echolalic speech.

A six-year-old boy. He talks out of turn, runs around the room, kicks, hits, pushes, and interferes verbally and physically with the activities of other children. This obtrusive behavior resulted in his having been transferred from one public school to another soon after the beginning of the school year, and his expulsion from the second school after one week of attendance, whereupon he was referred to the Laboratory school. His academic skills are below beginning kindergarten achievement.

An eight-year-old girl. She is not a behavior problem but her academic achievement is at beginning first-grade level. Writing is her most advanced skill. In the regular public school, she was in the third grade, but obviously could not do the work. Her social behavior, too, is below that expected of an eight-year-old.

These children appear to be representative of the severely behaviorally handicapped young children found in other comparable communities in the U.S.

4. The Physical Facilities

The two classrooms are separated by a large observational room between them as shown in Figure 1. Each classroom is 19 x 34 feet, and

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each has three adjoining small rooms at one side: a bathroom with child-sized toilets and sinks, a wet room with a sink for water play and other activities such as painting, clay modeling, etc., and a quiet room with dolls, doll beds, and play-sized kitchen equipment. Both the wet room and the quiet room are readily alterable so that they are suitable for library activities or a preferred playroom. Each of the three rooms is equipped with suspended microphones and each has large windows facing the main classroom, making activities in those rooms easily observable and audible from the main classroom and from the observation room directly opposite. The observation room, accommodating about six people, is elevated about three feet above the main classroom, its one-way mirrors projecting into the classroom at a 30-degree angle, thus permitting an unobstructed view of all the areas. Directly below the one-way mirrors in the classroom are three small booths used by the children for academic work. The classroom is equipped with reading materials, large building blocks, and table toys such as small blocks, beads, crayons, paper, scissors, etc.

One floor below the classrooms is a series of small rooms each equipped with listening and recording devices and each having an adjoining observation room with a one-way mirror. These rooms are used for the study of an individual child, and for student and teacher training, as well.

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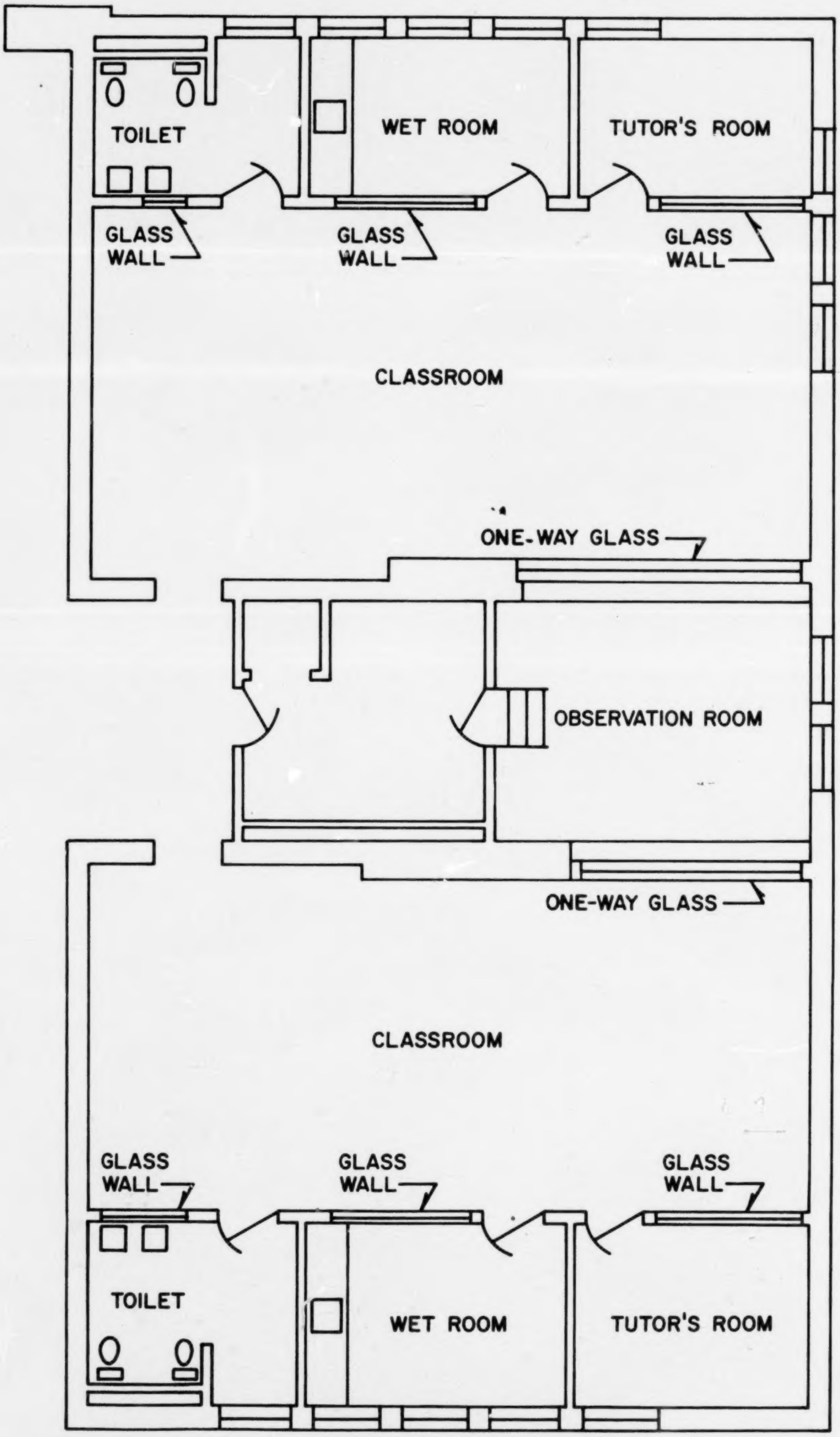
A large, fenced, outdoor play yard in which there is a variety of wheel toys and play equipment completes the physical facilities.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WET ROOM
TUTOR'S ROOM

Figure 4-1

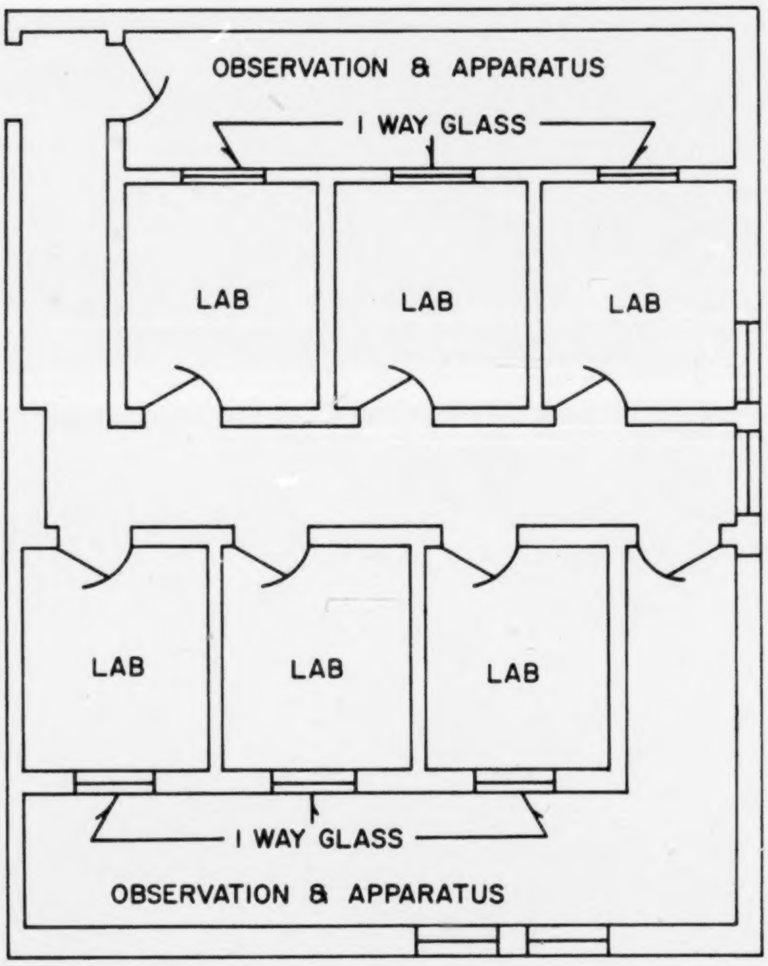
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Figure 4-2

5. Guidelines for the Development of a Curriculum, Materials, and Teaching Practices

This section gives a brief overview of the behavioral engineering principles that are used in this research to develop the curriculum, materials, and teaching practices. These guidelines are derived from a behavior theory of human behavior and development (Bijou, 1968; Bijou & Baer, 1961 & 1965; and Skinner, 1953).

Learning and Teaching

Teaching is defined as the arrangement of conditions to expedite learning (Skinner, 1968). A child can learn with or without instruction, but instruction should help him to learn faster and better. Every teacher can teach, but some are far more effective than others. The effective teacher is one who intuitively or planfully knows how to set up situations conducive to learning, i.e., knows how to break a task down and present the parts in ways a child can learn, how to encourage active, enthusiastic participation, how to strengthen new behaviors, and how to maintain and extend them.

To define the effective teacher as one who can stimulate a child to learn in an enjoyable and productive manner is to attribute to her skills in (1) managing contingencies of "reinforcement," (2) programming stimulus sequences (the curriculum and teaching practices), and (3) creating a positive atmosphere for learning because all of these conditions are essential for learning.

Managing Contingencies of Reinforcement

One aspect of an effective educational environment is the teacher's ability to manage events that occur immediately after the proper educational and social response is made. In this category, we include (1) the proper procedures for evaluating the effectiveness of reinforcers in effect for each child, (2) the proper use of schedules of reinforcement to improve study behavior and motivation for school work, and (3) the differential application of contingencies for stimulus control tasks (reading, spelling, and arithmetic) and for shaping tasks (writing and drawing).

Evaluating the effectiveness of reinforcers for a child requires far more than an impression of what a child likes or what one thinks he should like. It requires extended observation of sequences of the child's interactions with activities in order to determine which contingencies are functional in keeping him working on a task. It also requires continuous monitoring of his school work, because the kinds of conditioned reinforcers used in the classroom often change in effectiveness with changes in setting factors (e.g., changes in the family situation) and with progress in learning. The teacher cannot assume that once she has identified a class of reinforcers that are functional for a child she has completed the task of "understanding the motivation" of that child. She must be vigilant in seeking new reinforcers that are at least equal to or even more effective than those she is using, if for no other reason than to avoid decreases in proficiency because of satiation with those stimuli.

Evaluating schedules of reinforcement in light of the target or desired terminal behavior calls for a knowledge of the kinds of behavior that are generated when the intermittencies of reinforcing contacts are changed. Schedules are varied to increase the effectiveness of a child's study behavior. For example, a continuous schedule of reinforcement may be changed to an increasing ratio schedule to build longer and longer chains of paying attention to instructions, carrying out instructions, moving from task to task without dawdling, etc. Or a continuous schedule of reinforcement may be changed to an increasing ratio schedule to encourage working independently and productively, e.g., gradually shifting from reinforcing every correct response on a page to reinforcing every full page of correct responses. These procedures are elaborated in chapter 7 which describes the reading program.

Schedules of reinforcement are also altered to revise old conditioned reinforcers or to develop new ones (wants, interests, likes, needs, etc.). Reference here is to the so-called "percentage reinforcement." By percentage reinforcement schedule, we mean the proportion of time in which the contrived reinforcer (mark, token) is given together with a social reinforcer. This type of contingency is discussed in detail in chapter 7 on the reading program and chapter 11 on the use of behavior modification techniques in the classroom.

We turn now to the third aspect of managing the contingencies of reinforcement which pertains to delivering reinforcers in ways that are appropriate to the behavior to be learned. We are referring here to the differential techniques used (1) to modify the form of a response, such as in writing letters of the alphabet, and (2) to develop new knowledge, such as in reading words. Both types of learning require the child to give a constructed response (writing and saying). However, writing skills are best acquired when contingencies follow shaping procedures, while learning to read words is most rapidly strengthened when contingencies follow stimulus control procedures. To improve a child's writing, the teacher should give contingencies for correct and incorrect responses in ways that strengthen the entire form of the response. To enhance his ability to read words, she should manage consequences to increase the probability that the child will make the accepted verbal response when the word is presented visually. We hasten to add that writing, and other manual skills as well, require stimulus control (e.g., paying attention to the details of the model to be copied); and reading involves, in addition, shaping procedures (e.g., learning to articulate words).

Programming Stimulus Sequences

Stimulus sequences prepared for teaching consist of formal and informal programs. Formal programs, generally developed for teaching academic or vocational subjects, are constructed according to certain rules for programming and often include a manual of instructions. A formal program contains the basic material for use by all the children in a group but there are provisions for modifications which take into account individual differences in learning idiosyncrases and learning rates. The formal programs in use in the Laboratory classrooms are described in Chapters 7 and 8. Informal programs, on the other hand, may vary considerably in their application from child to child. They are often "carried in the teacher's head" and are used to build very specific and relatively small chains of behavior - such as hand-raising, hanging up a coat, attention to a task, etc. An informal program starts at the point where the child is currently functioning and uses a combination of cues and reinforcement of approximations to achieve the terminal behavior. When a problem is not quickly ameliorated by an informal program, a more formal program is developed. In actual practice, programs fall into a continuum of formality, ranging from very informal, spur-of-the-moment to carefully structured, strictly programmed material. Procedures for using informal programs are described in Chapter 9.

Positive Atmosphere for Learning

Preparation of a positively conducive atmosphere in the classroom is just as essential as all other aspects of the teaching - learning situation, mainly because it enhances the child's responsiveness to school material and heightens the effectiveness of the contingencies of reinforcement.

There are three ways in which a positive atmosphere may be created. One is by making the physical structure of the classroom attractive; another is by making the class day functionally flexible (see Chapter 5); and the third is by generating in the teacher an optimistic attitude about the potentialities of each of the children in her class. No one would deny that an optimistic attitude in a teacher, or any other being, for that matter, is preferable to a pessimistic attitude. But in a behavioral approach to teaching, this requirement stems from one of the basic assumptions of the theory; namely, that the behavior of a child is determined by the history of the child and the circumstances (which include the teacher) at the time he is being observed. Hence, when a child is making reasonable progress in an academic or social program, the materials and the reinforcing contingencies in effect are assumed to be up to the mark for him. On the other hand, when he falters, the materials or the reinforcers, or both, are assumed to be inadequate for him and the course of action is clear: Analyze the problem, modify conditions, monitor the child's performance under the new conditions, and, if necessary, modify and revise again and again until the child shows progress. The cherished optimistic attitude, therefore, carries with it a willingness to view each problem behavior as a personal challenge to modify the educational environment so that undesirable behavior will give way to desirable behavior. Under these circumstances, improvement in the child's behavior, even the slightest, will be highly reinforcing to the teacher.

6. Structure of the Class Day

Over the past three years, the structural components (hours in the school day, duration of lessons, order of activities, etc.) of the school day have been varied to make the classroom culture a happy and productive learning environment for each child. Perhaps the outstanding feature of the structure of the day is its flexibility, a characteristic that evolved as a result of tailoring the instruction to the individual needs of the child. Freedom to vary the daily schedule enables the teacher to make assignments according to each child's abilities and to vary the components of the classroom as needed to enhance motivation (reinforcement contingencies).

During 1970-71, the classes met from 8:15 a.m. to 12:30 p.m. daily. As each child arrived, he was greeted by the teacher who served him breakfast and encouraged him to talk about his after-school and evening experiences during the previous day, or before coming to school that morning. Relaxed conversations of this sort not only increase communication skills and strengthen relationships among members of the class but help to remove emotional predispositions (being angry or afraid) which interfere with having a pleasant school day.

8:15 - 8:45	Greeting and breakfast time
8:45 - 9:10	Study period 1
9:10 - 9:35	Study period 2
9:35 - 10:00	Language period
10:00 - 10:30	Study period 3
10:30	Store time
10:30 - 11:00	Recess
11:00 - 11:30	Study period 4
11:30 - 12:00	Store time
12:00 - 12:30	Study period 5

Each child's assignment for each study period, prepared by the teacher and her assistant the afternoon before, is contained in a color-coded folder in his desk. With prompts from the teacher, the child refers to the master chart on the bulletin board for instructions on which folder to use for each period. Not all the children will necessarily be working on the same subject at the same time, and those who are will undoubtedly be working at different levels of materials within any subject. Nor will each child get the same amount or kind of help with an assignment. The teacher will help some, the assistant others, and some will work alone, depending on the achievement level and the study skills they have acquired. A typical daily program is something like this:

Study period 1, Writing - copying from typed cards, working in a small group under the teacher's supervision.

Study period 2, Arithmetic - doing simple addition facts, also in a small teacher-supervised group.

Language period - working on words and sentences in communication skills with whole class participating.

Study period 3, Reading - learning new words and reading for comprehension, working alone with a tutor.

Study period 4, Writing - writing numbers and letters from dictation, and writing in a workbook.

7. The Reading Program

Introduction: A Behavior Analysis of Reading

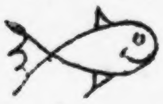
Reading is verbal behavior in response to written or printed symbols in reference to objects, people, and situations. The child's society determines (1) the form of the textual stimuli (letters, words, and paragraphs), (2) the combinations of sounds that will be reinforced when they are spoken in the presence of textual stimuli, and (3) the other responses (verbal or non-verbal) which are accepted by the community as comprehending or understanding the material read (e.g., answering written or oral questions, paraphrasing, summarizing, following directions, or matching pictures or objects with written words or phrases (Observer, 1970; and Skinner, 1957).

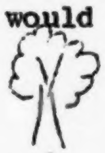
The "normal reader" learns to respond appropriately to the symbolic equivalence of members of three classes of stimuli: textual stimuli, auditory stimuli, and referents to both. For example, when a reader "reads" the textual stimulus "fish," he not only says "fish" (i.e., produces an auditory stimulus that is symbolically equivalent to the written stimulus) but he is also able to identify a picture of a strictly acquatic, cold-blooded vertebrate with fins or he can define the word "fish" acceptably (i.e., he identifies a referent of the previous auditory and textual stimuli). An individual who is able to respond correctly in both of these contexts provides evidence that he can read the word "fish." He indicates that the auditory stimulus and the referent correspond symbolically to the textual stimulus.

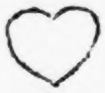
Further explanation concerning the referents (stimuli) of textual and auditory stimuli may be helpful. Appropriate responses to these stimuli are the criteria for comprehension, so they will be referred to as the comprehension class. This can be broken up into a number of subclasses such as pictures, objects, demonstrations, definitions, and following directions. Some of these may have textual or auditory forms. For example, simple line drawings of people and objects are actually textual stimuli; definitions can be textual or auditory. However, in reading there are two major distinctions between textual and auditory stimuli on the one hand and their referents on the other. (1) While a given textual stimulus has only one auditory equivalent and a given auditory stimulus has only one textual equivalent, a given textual or auditory stimulus can have a large number of comprehension equivalents. For example, several definitions of a word are possible in addition to other comprehension subclasses. (2) A referent never has the same physical topography (i.e., form) as its textual or auditory equivalents. For example, an acceptable referent of the textual and auditory stimuli "fish" may be the textual or auditory stimulus "trout." But "trout" does not have the same topography as "fish."

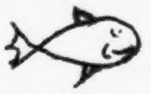
If a child is to engage in these complex behaviors, he must be capable of discriminating between members of the same stimulus class.

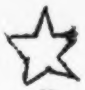
For example, each of the pictures below has an auditory and a textual equivalent. It would not be possible to differentially apply one of


1.


A


B


C


D

those equivalents to "C", if the child could not match 1 with "C." Failure to match would indicate that the child literally could not tell the difference between the pictures. The same reasoning holds for the textual stimuli below. It would not be possible to respond

fish	tree	heart	fish	star
1.	A	B	C	D

differentially to the "C" stimulus with the appropriate auditory equivalent if the child could not match that stimulus with 1. Thus the initial task in teaching a child to read is to be sure that he has the ability to discriminate similar stimuli within the textual, auditory, and comprehension classes.

If the pictures can be considered representative of the comprehension classes, then a table of matching-to-sample tasks can be constructed in which a member of each class serves as a discriminative stimulus controlling responses to identical members of the same class, or to symbolic equivalents from the other classes. A series of such tasks is presented in Table 7-1. None of the tasks define reading since

- - - - - - - - - - - - - - - -

Insert Table 7-1 about here

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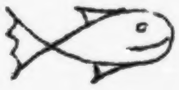
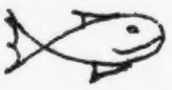
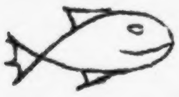
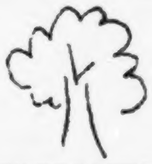
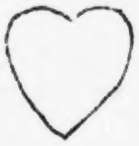
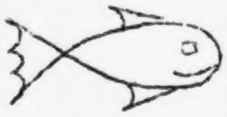
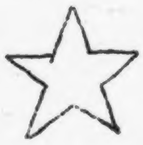
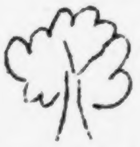
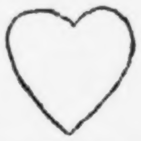
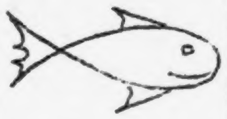
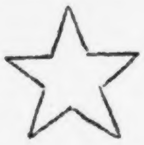
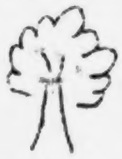
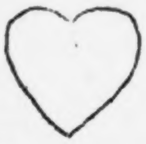
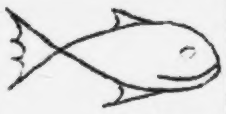
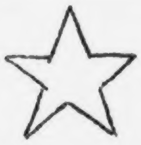
each one requires discriminated responses. In the first task, the child chooses on the basis of the stimulus picture or word in the left-hand column of the table, an identical or equivalent stimulus from the four in the row at the right. It is unnecessary for him to identify all the choices; he need recognize only the correct stimulus. Reading, however, involves the production (saying) of the correct stimulus. It is the difference between multiple choice and essay examinations, the former requiring selected responses and the latter constructed responses. Constructed versions of all of the tasks in Table 7-1 are possible. They represent some very important behaviors. The second task is often called object naming; the fourth is writing from dictation; the fifth is verbal imitation; the sixth is listening comprehension; the seventh is writing from a model; the eighth is oral reading; and the ninth is reading comprehension. Only the last two tasks define reading behavior. Some of the others require motor skills (i.e., writing and drawing) that are largely irrelevant to reading. (These will be discussed in Chapter 8 which describes the writing program.) The others - verbal imitation,

Table 7-1

Match-to-Sample Tasks Relating Auditory, Textual, and Comprehension Equivalents

1. 	tree	heart	fish (textual)	star
2. 	tree	heart	fish (auditory)	star
3. 				
4. fish (auditory)	tree	heart	fish (auditory)	star
5. fish (auditory)	tree	heart	fish (auditory)	star
6. fish (auditory)				
7. fish (textual)	tree	heart	fish (auditory)	star
8. fish (textual)	tree	heart	fish (auditory)	star
9. fish (textual)				

object naming, and listening comprehension - do have particular relevance for the development of reading behavior.

A child may discriminate auditory stimuli but may not be able to imitate them accurately. If those in the child's community (teachers, parents, siblings) cannot understand him, he will not be reinforced for responses related to reading and his reading behavior will not be strengthened. Verbal imitative behavior can have another role in the acquisition of reading. If the auditory equivalent is modeled for the child, initial verbal responses to textual stimuli can easily be evoked.

A child is generally able to name a large number of objects and events before he learns to recognize their symbols, or as we would say, before he learns to bring his verbal behavior under the control of textual stimuli. In teaching, it is axiomatic from a behavior analysis point of view that the teacher begin instruction with the behaviors the child already has that are closest to the desired terminal behavior. Thus any of the child's listening comprehension skills should be taken into account when preparing a reading program for him.

Discriminated behaviors (i.e., selecting a correct stimulus like "point to 'fish' in this row of pictures") are easier to acquire than constructed behaviors (i.e., producing a correct verbal or written response). In addition, distractor stimuli (the choices other than the correct one) involved in discriminated tasks can be varied in degree of similarity to the correct stimulus and thus the probability of a correct response can be held nearly constant. Well-sequenced reading materials take full advantage of both these facts.

It is important that a child's early reading efforts are positively reinforced in order to make reading discriminative for positive reinforcement. If this is done, the stimulus aspects of the reading behavior itself become reinforcing and the task of motivating the child is far simpler. Since those in his community who are involved in his reading tend to reinforce only terminal reading behaviors (i.e., constructed verbal and comprehension responses to textual stimuli), it is all the more essential that the child be provided with opportunities for positive reinforcement from the beginning of instruction. This can be accomplished by initially teaching some minimal sight vocabulary. Children often appear to be amazed that they can read three or four simple words. Word attack skills such as sounding-out words phonetically are necessary if the child is to become a proficient reader, but their introduction should be delayed until they can be demonstrated to be useful to the child.

The Individualized Reading Program

The present form of the Individualized Reading Program is a revision of the program in operation during the previous years (1968-70). It is designed to provide the child with a sight reading vocabulary of

270 words. A child can generally complete the entire program without requiring auxiliary programs. This is not to say, however, that the terminal behaviors generated by the reading program can be defined as "the ability to read." To achieve that end goal, the Individualized Reading Program is used in conjunction with programs in: letter recognition, naming, and discrimination; elementary phonics; spelling, writing; and language.

This chapter describes (1) the components of the program and the procedures for using them; (2) the pre- and posttests; (3) the contingencies for strengthening correct responses; (4) the procedures for dealing with incorrect responses; and (5) the procedures for monitoring reading behavior.

Components of the Program

The Individualized Reading Program (IRP) consists of 27 sets of graded verbal material. Every set has 10 subsets, each of which introduces a single word. Thus there are 10 words per set and 270 words in the entire program. Each subset presents four separate tasks: Listening comprehension (LC), Reading discrimination (RD), Read back (RB), and Reading Comprehension (RC). Each task within a subset not only focuses on the new word for that subset but also contains a review of previously presented words. A fifth task, Stories (exercises in sentence and paragraph comprehension), occurs at the end of some of the subsets.

Listening comprehension (LC). The first task the child encounters in a subset is listening comprehension or LC task. It is included to assure the teachers that the child understands the meaning of a word he hears (i.e., he can answer at least one question relative to it). A sample page from Set IV is shown in Figure 7-1. The LC pages are arranged in the form shown in Figure 7-1 because they are used with a Min/Max teaching machine, a blue plastic box that permits presentation of a single item at a time. The area between any two horizontal lines on a page is called a frame and there are usually five frames to a page. The child is taught to expose the upper half of a frame by turning the knobs at the top sides of the Min/Max box. In the LC task, the vertical center portion of the page (i.e., the area containing the written words) is covered. The teacher or tutor pronounces the word and asks the child to mark whether or not the word describes the picture on the left side of the page. The child answers by circling the smiling "yes" or the frowning "no" face on the right side of the page. The child is then instructed to turn the knob of the teaching machine just enough to expose the lower half of the frame and see the "+" sign under the correct face, the feedback contingency.

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Insert Figure 7-1 about here

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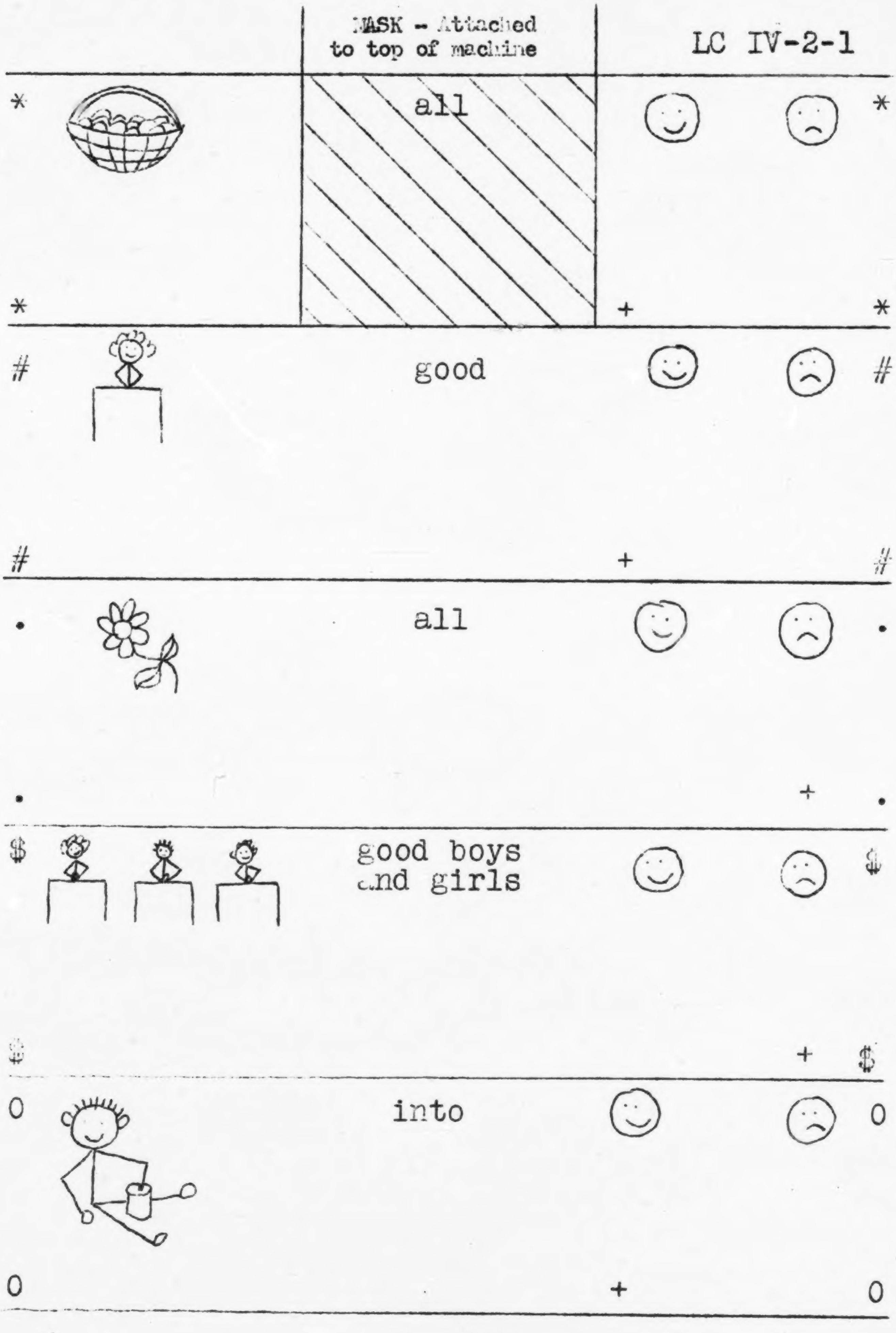
MASK - Attached to top of machine
LC IV-2-1
all
good
all
good boys and girls
into

Figure 7-1

Reading discrimination (RD). The second task is reading discrimination or RD task. This task teaches the child (1) to select from a series of printed words or letters the written equivalent of a word spoken by the teacher, and (2) to say the word as he looks at its printed form. The similarity in appearance of the choices is gradually increased as the task proceeds. A sample page (RD IV-2-1) is shown in Figure 7-2.

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Insert Figure 7-2 about here

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The teacher pronounces the correct word, the child circles the word, says the word, and then rolls the paper up to expose the "+" sign.

RD tasks are often programmed on a Language Master tape recorder instead of a printed Min/Max RD sheet. The Language Master is used with cards (see Figures 7-3 and 7-4) that have the printed words and a strip of magnetic tape attached. The child inserts the card into the Language Master and the prerecorded tape pronounces the word. This teaching machine enables the child to work with or without a teacher or tutor. RD tasks presented in the Language Master are more difficult than when they are presented in the Min/Max since the child must emit a sequence of seven responses for every Language Master card as compared with four responses for a Min/Max frame. The response sequences are summarized below:

- -

Insert Figures 7-3 and 7-4 about here

- -

Language Master RD
Response Sequence

1. Pick up the card
2. Place it in machine correctly
3. Point to word pronounced by machine
4. Say the word
5. Turn card over for response feedback
6. Replace card in stack
7. Record the correctness of 3 above on a self-report sheet (This response is not added until the first six are well established.)

Min/Max RD
Response Sequence

1. Turn Min/Max to expose new frame
2. Circle word pronounced by tutor
3. Say the word
4. Turn Min/Max to expose "+" sign

Read back (RB). The third task is the read back or RB task. Here

RD IV-2-1

*	pool	gild	good	*
*			+	*
#	read	rcwf	suvd	#
#	+			#
.	-----	all	-----	.
		+		.
$	hdfhvj	mpsvgi	all	$
$			+	$
0	egibf	all	kpvmp	0
0		+		0

Figure 7-2

Note: The card automatically moves from right to left when placed in the Language Master machine.

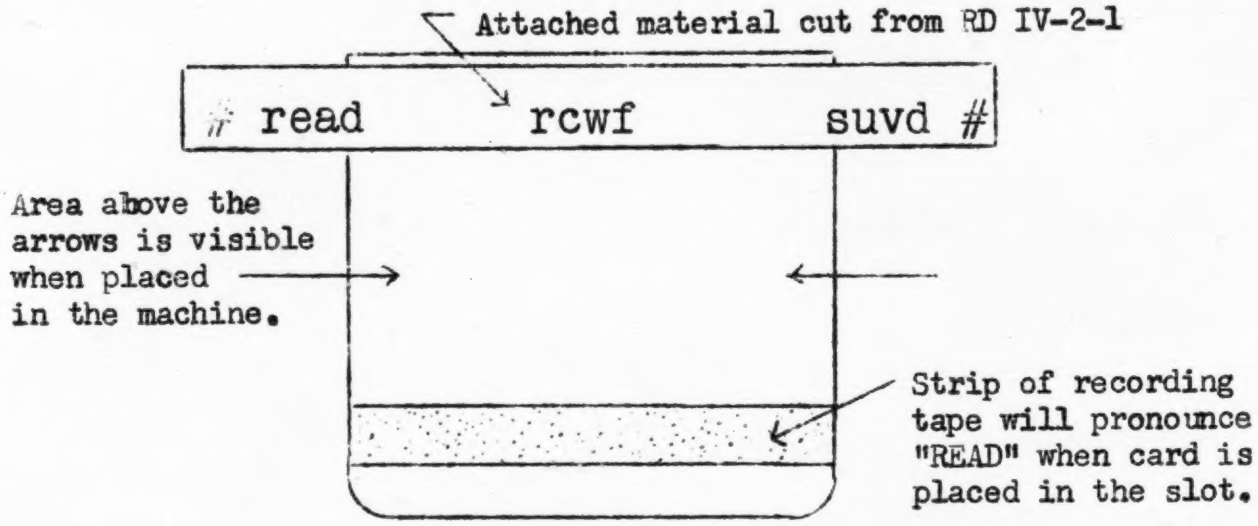
Attached material cut from RD IV-2-1
# read
rcwf
suvd #
Area above the arrows is visible when placed in the machine.
Strip of recording tape will pronounce "READ" when card is placed in the slot.

Figure 7-3

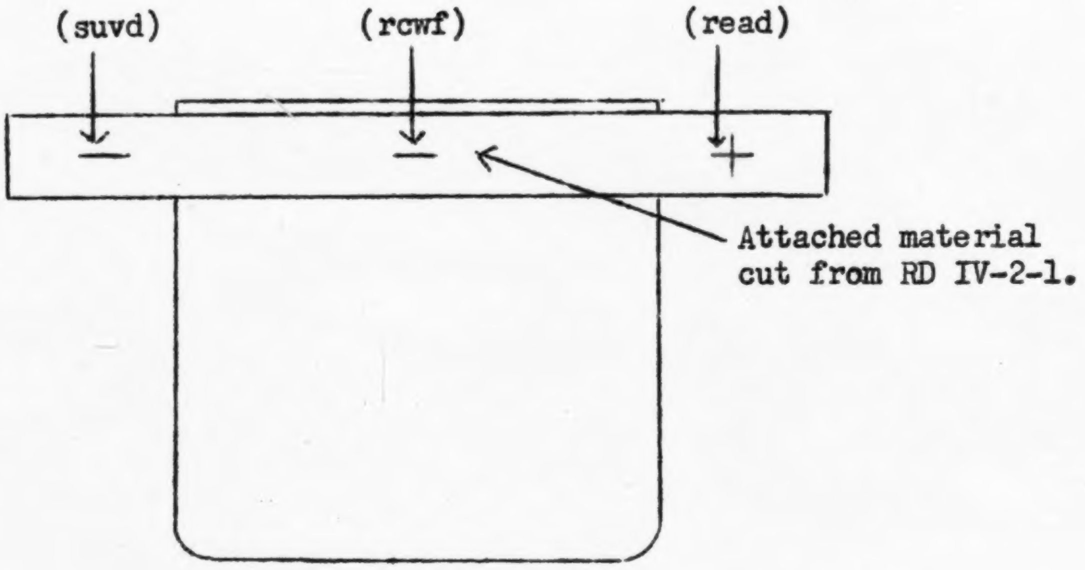
(suvd)
(rcwf)
(read)
Attached material cut from RD IV-2-1.

Figure 7-4

the child gives verbally constructed responses to printed words. A sample page (RB IV-2) is shown in Figure 7-5. The child is required

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Insert Figure 7-5 about here

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to read the entire page audibly and distinctly without prompts from the teacher. Note that the lower part of the sample shown in Figure 7-5 is composed of phrases and sentences. Since the child initially learns to read single words, he tends to read these phrases as strings of single words (i.e., slowly and haltingly). Hence in this component, he is taught to link words together. After the child has verbally identified each word, the teacher reads the words aloud in a smooth, conversational-sounding phrase. The child is reinforced for correctly identifying the words and for reading them in phrase-like fashion.

Since there is no provision in the written material for response feedback, the teacher provides this information through (1) intermittent social reinforcement of correct responses (e.g., "That's very good, John.") and (2) the correction of incorrect responses.

Reading comprehension (RC). The final task in a subset is the reading comprehension or RC task. The child makes comprehension responses by answering questions about the word or phrase he reads. The printed RC page (Figure 7-6) is identical to the LC page shown in

- - - - - - - - - - - - - - - - -

Insert Figure 7-6 about here

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Figure 7-1. In the RC task, however, the center portion of the page is no longer covered, and is, of course, visible to the child. The child reads the word out loud, indicates whether or not the word describes the picture by circling the appropriate "yes" or "no" face, and turns the Min/Max knob to see by the location of the "+" sign whether his response is correct.

The four tasks (LC, RD, RB, and RC) in a subset all focus on a single word that has not been encountered in previous subsets. In the case of Subset 2, Set IV (Figures 7-1, 7-2, 7-5, and 7-6), the new word is "all." The other words encountered throughout the four tasks were introduced in preceding subsets and are only reviewed in Subset 2.

Stories: Sentence and Paragraph Comprehension. The 270 word vocabulary in the reading program list is keyed to a graded series of commercially published elementary readers, the Bank Street Readers. The opportunity to read a story from a book is given as a special bonus for good progress through the reading program. The stories are presented like the RB task with the teacher giving reinforcement, correcting

RB IV-2

all	into	night
good	read	all
into	night	read

all	good

Boys and girls play.

Good night.

They read in school.

Up and down.

Lights on stores and houses.

Run into the stores.

Figure 7-5

RC IV-2-1

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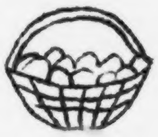
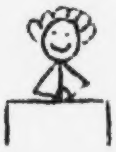
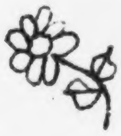
*  all ☺ ☹ *

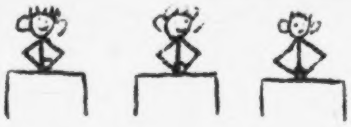
* + *

#  good ☺ ☹ \#

# + \#

•  all ☺ ☹ •

• + •

$  good boys and girls ☺ ☹ $

$ + $

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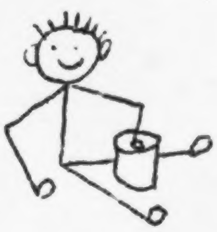
0  into ☺ ☹ 0

0 + 0

Figure 7-6

errors, and asking questions about the content of the material in accordance with instructions provided with the story.

Pre- and Posttests

The pretest is used as a basis for deleting, from his reading program, material with which the child is already familiar. Figure 7-7 is the pretest for Set IV. After assuring the child that he is not expected to know all of the words, the teacher points to each word and asks him to read it. To avoid strengthening incorrect responses, the teacher gives token and social reinforcements only for first, unassisted correct responses. Incorrect responses are not corrected; the teacher makes neutral comments when they occur (e.g., "OK", "All right," "Continue," etc.). The listening comprehension and reading discrimination tasks are eliminated for any word the child identifies correctly on the pretest; the read back and reading comprehension tasks are retained for all subsets. If, for example, the first 10 subsets in Set IV are to be administered, the first task in the set is Pretest IV which includes all of the words in the set (see Table 7-2). If the child correctly identifies the words "into" and "all" on the pretest, he is not given LC IV-1, RD IV-1, LC IV-2, and RD IV-2. His first task following the pretest is RB IV-1 for the word "into", and so on for the remaining words in the set. RC IV-10, the last subtest in Set IV, is followed by a posttest which is the same as the pretest but is administered like the RB task.

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Insert Figure 7-7 about here

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Insert Table 7-2 about here

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Reinforcement Contingencies for Correct Reading Responses and for Improved Precurrent Behavior

Strengthening reading behavior: social reinforcement. Correct responses are strengthened by immediate comments of approval, such as, "Good, You're working hard today," "That's the way to say it," or "I like the way you're doing that."

In view of the strengthening effect of a reinforcement contingency, it is obvious that the child should be reinforced after he has engaged in some behavior that the teacher wants to encourage. In the reading program, these behaviors are reinforced:

Pre-Post Test IV

into
morning
sunlight

all
sun
say
he

over
comes
Hi

Figure 7-7

Table 7-2

Sequence of Task Administration for Items
Within a Subset of IRP

Set	Subset	Task	New Word
IV	--	Pretest	All words in Set IV
IV	1	LC	into
IV	1	RD	into
IV	1	RB	into
IV	1	RC	into
IV	2	LC	all
IV	2	RD	all
IV	2	RB	all
IV	2	RC	all
'	'	'	'
'	'	'	'
'	'	'	'
'	'	'	'
'	'	'	'
'	'	'	'
IV	10	LC	he
IV	10	RD	he
IV	10	RB	he
IV	10	RC	he
IV	--	Posttest	All words in Set IV
V	--	Pretest	All words in Set V
V	1	LC	who
V	1	RD	who
V	1	RB	who
V	1	RC	who

LC: Circling the appropriate "yes" or "no" face.

RD: Circling the written word pronounced by the teacher, and then saying the word.

RB: Correctly identifying the word or words, and proper phrasing.

RC: Correctly identifying the word or words, proper phrasing, and circling the appropriate "yes" or "no" face.

Stories: Correctly identifying the word or words, proper phrasing, and acceptable responses to questions about the material.

Pre-Posttests: Correctly identifying each word in the tests.

If a child has just embarked upon the reading program, reinforcement is given as soon as possible after each correct response but after some progress, reinforcement is delayed slightly - until the child has exposed the "+" symbol in doing the LC, RD, and RC tasks.

The four classes of behavior described above (i.e., circling, imitating, identifying, and phrasing) will not ordinarily occur even at a low frequency (thus there will be few opportunities to reinforce them) unless the child has developed the following precurrent behaviors:

1. Sit quietly in his seat
2. Remain oriented toward the reading materials
3. Maintain eye contact with those materials
4. Hold the pencil correctly
5. Operate the teaching machines correctly
6. Discriminate one group of letters from a different group of letters
7. Respond to verbal instructions
8. Use the pencil for circling only
9. Not respond to surrounding noises
10. Speak loudly enough to be heard

Many of the children in the classes have been referred because they do not have these behaviors. (They are said to have poor "impulse control".) Thus part of the reading program and procedure is devoted to shaping and maintaining these background skills.

The teacher does not give social reinforcement for a correct response if the child is engaging in a behavior that interferes with learning (e.g., disruptive noise, scribbling, playing with the teaching machine, etc.). Adherence to this practice avoids the possibility of strengthening the off-task behavior that is "chained-into" the correct behavior.

Verbal reinforcements vary along a quality continuum. The timbre and intensity of the teacher's voice can control the child's behavior independent of the specific word content. It is theoretically possible to strengthen a child's behavior by saying in a soft, sincere, warm voice "That's terrible, Sammy" or to suppress his behavior by screaming angrily, "That's the best circle I've ever seen, Ed." Repetitious social reinforcers (i.e., those that do not vary from response to response in terms of word content, volume, timbre, and number of simultaneous non-verbal reinforcers) rapidly lose their effectiveness.

In addition to verbal reinforcements, there are at least four classes of non-verbal responses that may function as social reinforcers because of the child's past history or current teaching: (1) eye-contact with the child, (2) smiling, (3) head nodding, and (4) physical contact (e.g., back-patting, hand-holding, hair-ruffling).

Social reinforcers derive their effectiveness from the child's experiences prior to coming to school. If, for example, the mother, during the child's infancy, did not pair her verbal comments with such primary reinforcers as food, water, opportunity to sleep, exploratory behavior, and cessation of aversive stimulation, that is, if she did not smile and make approving remarks when the baby ate well, played happily, splashed in the bathtub, etc., it is unlikely that the teacher's verbal contingencies would function as social reinforcers in the school situation. Social reinforcers, a class of learned or acquired reinforcers, are tremendously important in the early school years for social reinforcement is one of the few techniques to strengthen academic behaviors that the public school teacher has at her disposal.

Strengthening Social Reinforcers With Token Reinforcers. If a child's behavior is insensitive to the teacher's comments and displays of approval (i.e., if the verbal and non-verbal contingent behavior of the teacher is not reinforcing the child), the teacher's first job is to try to increase the reinforcement value of these contingencies. This may be accomplished by arranging conditions so that verbal approval always precedes something that does, in fact, reinforce the child's behavior, such as an activity, a bit of food, a toy, the opportunity to watch a cartoon, etc. If verbal approval is a cue for a reinforcer, it eventually becomes a reinforcer itself. However, since it is impracticable to give a child a toy for the hundreds of verbal-toy pairings that might be necessary, a simpler procedure is used. This is the token reinforcement system (sometimes called a token economy). Tokens take many forms. In the Laboratory classrooms, green marks on small sheets of paper are used in place of tokens. They are accumulated and exchanged for any food, toys, and activities that the child chooses from the offerings. The marks have several advantages: (1) They can be given immediately after the desired behavior occurs. (2) They are tangible objects. (3) They can be exchanged for many things and thus do not show satiation effects. (4) They are easy to dispense. (5) They quickly gain control over the child's social and academic behaviors.

Marks, like tokens, are contrived reinforcers and should be treated as such. It is not very likely that peers, parents, other adults, and teachers outside the classroom environment would consistently reinforce the child's desirable behaviors with green marks exchangeable for "goodies". But verbal comments and approval are natural reinforcers and it is very likely, indeed, that individuals outside a classroom would reinforce a child's desirable behaviors in this way. Hence a continual effort is made to establish or re-establish the social reinforcing function of verbal comments. To accomplish this goal, a correct or desirable response is immediately followed by verbal approval and a green mark.

In the reading program, marks are given contingently for correct responses, and for precurrent reading behaviors and a completed page is the unit of exchange. No matter how many full pages of marks the teacher gives during the reading session, she makes certain that the child leaves the session with at least one partially completed page. An incomplete page forestalls a learning pause. This may mean that occasionally at the end of the session the teacher may have to put two to five unearned marks on a new page.

Building independent reading behavior with schedules of reinforcement. Although reinforcement strengthens learning, reading behaviors can be maintained without the delivery of a reinforcer after each response. This principle is important because the objective of the Individualized Reading Program is not only to teach the child to read but to enjoy reading, and to read independently. The child should eventually read without token reinforcers and without the supervision of a teacher. Two types of social reinforcement schedules are used in teaching a child to read independently:

Fixed Ratio - A fixed minimum number of responses is required for every reinforced response, and the reinforced response must be correct. Examples: Fixed ratio 1 - Every correct response is reinforced (this is a continuous schedule of reinforcement). Fixed ratio 3 - Every third response is reinforced, provided that it is correct (i.e., if 2 incorrect responses are followed by a correct response, the 1 correct response is reinforced; if 3 incorrect responses are followed by 4 correct responses, the 4th and 7th correct responses are reinforced; if 6 consecutive correct responses occur, the 3rd and 6th responses are reinforced).

Variable Ratio - A variable minimum number of responses is required for every reinforced response, and the reinforced response must be correct. The average minimum number of responses (i.e., total responses divided by total reinforcers) defines the schedule. Example: Variable ratio 3 - The 3rd, 5th, 10th, 11th, 14th, and 18th responses are reinforced. Since there are 18 responses and 6 reinforcers, 18/6=3. On the average, every third response is reinforced.

Marks do not have to accompany verbal comments all of the time in order to establish approval as a social reinforcer. A third type of schedule, percentage reinforcement, is used to specify the percentage of socially reinforced responses that are also reinforced with marks. Examples: 66% - 2 out of every 3 social reinforcers are accompanied by a mark reinforcer. 10% - 1 out of every 10 social reinforcers is accompanied by a mark reinforcer.

When a child enters the reading program, a continuous schedule of social reinforcement and a 100% mark reinforcement schedule are used. As soon as accurate circling, verbal identification, and imitation are established, the schedules are thinned by decreasing the frequency of social reinforcement and the number of times approval and marks are paired. Social and mark reinforcers are generally thinned independently (with the exception that a social reinforcer must always accompany a mark reinforcer but not vice versa). In general, the schedule of mark reinforcement is thinner than the social schedule.

Schedules are thinned for three reasons. First, the process results in stable reading and study behaviors. Second, the child's productive output (i.e., items covered in the 25-minute study period) increases. Third, on return to the public school system, the child is prepared to respond to the social and intrinsic reinforcers that are given in the regular classroom. Thus, if the child is working at the rate of 100 to 125 items per session (2 to 3 new words) at the end of the school year, the reinforcement schedule would be variable ratio 15-20 (social), 0% (token).

Obviously the mark schedule is eliminated before the social schedule. In this case, marks are still given but they are not contingent upon any response. This strategy does not allow the reinforcement of undesirable behaviors, but it enables the child to exchange the marks later so he is not eliminated from the institutionalized activity of "going to the store". "Going to the store" is eliminated near the end of the school year for all children simultaneously.

The teacher is in the best position to determine (1) when the reinforcement schedules should be thinned, (2) whether or not verbal approval and marks actually strengthen reading behavior in specific instances, and (3) whether the reading tasks are aversive or neutral to the child. She watches the child for the child teaches her how to teach him. If he slows down when reinforcement frequency is decreased, it is usually because his behavior was not well established under the old schedule. If he participates reluctantly in the reading assignment, it may be due to lack of reinforcement in previous reading experiences, or to the acquired aversive property of the task. The child's behavior tells the teacher to alter the learning situation by intensifying the schedules, strengthening the values of reinforcers, increasing the number of different reinforcers, or moving the child on to more interesting academic materials.

Managing Incorrect Responses to Maximize Subsequent Correct Responses

The programmed reading materials should generate almost errorless performance. In recognition of the fact that the IRP is imperfect for each individual child (and will probably also be so), there are definite procedures for handling incorrect responses. They are designed to change the circumstances under which the error was made so that it is less likely that the child will make the same error on similar occasions. Specific correctional procedures are used (1) at the time the incorrect response is made, (2) after completion of a given task, and (3) after completion of an entire subset.

Monitoring Reading Behavior

Reading behaviors are monitored throughout to (1) provide an objective criterion for moving an individual child forward in the program, (2) indicate specific points at which an individual child experiences difficulty so the teacher can construct remedial units, and (3) provide a basis for revision of the IRP. During each reading session, a record is made of correct and incorrect responses and the contingencies used.

Data on the Individualized Reading Program

Materials and procedures for the teaching of reading should have provisions for the maintenance (memory) of the newly acquired behavior. For this reason the Individualized Reading Program incorporates a systematic review of all new words in each of the reading tasks. Also, reading materials and procedures should provide for a systematic check on the efficiency of the maintenance procedures. This is accomplished in the IRP by the posttests at the end of each 10-word set. Out of 1230 subsets given during the 1970-71 school year, there were only 43 errors on posttests (i.e., 3.5% errors). Approximately half of these errors were generated by the fact that posttests come immediately after the tenth subset in any given set. By the time a child takes the posttest, he has had no chance to review Subset 10 and very little chance to review Subsets 8 and 9. This is demonstrated in Table 7-3 which presents

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Insert Table 7-3 about here

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the number of times posttest items were missed as a function of their ordinal position within a set. Thus, words taught in Subset 1 of all sets were missed only twice on posttests for an error rate of 1.63%. Words taught in Subset 10 of all sets were missed 15 times on posttests for an error rate of 12.20%. This is probably a fair estimate of the efficiency of the systematic review procedures in IRP. Maintenance of new words is obviously decreased without these procedures.

The reading program is too long for the average child in the class to complete in a single school year. However, three children did complete it and were subsequently given commercially prepared reading textbooks. Two of these children were enrolled in the class for two consecutive years. The third (A.D.) was a hyperactive child who was referred from a public school first-grade due to "low academic achievement" and a "short attention span." Figure 7-8 is a cumulative record

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Insert Figure 7-8 about here

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of A.D.'s progress in the reading program. The open circles with a dot represent rate of correct responses and the closed circles represent rate of incorrect responses. Each data point represents reading output summarized over three reading days. Days in which no reading occurred (i.e., weekends) are not represented.

Throughout the first period, designated as A in Figure 8, A.D. read exclusively during a 25-minute tutored reading period at school. The rate of incorrect responding is characteristically low and the rate of correct responding is typical of the other children. If he had continued at this rate, he would have made approximately 8,700 reading responses by the end of the school year.

A.D.'s mother was given training on how to help her son in reading. At B in Figure 7-8, she began tutoring him at school as part of her training. As is shown, A.D.'s performance was unaffected. At C in Figure 7-8, the mother worked with her son on reading program at home. A.D.'s rate of learning shows a dramatic increase at this point and his rate of incorrect responses remains relatively constant. During this period, designated as AA, the mother did not tutor her son at the school or at home. Under this condition his performance was comparable to that for the initial portion of the year (the period marked A). During the next period, shown as CC in Figure 7-8, the mother again

Table 7-3

Number of Times Posttest Items Were Missed as a Function of Their Ordinal Position

Subset	Number of Posttest Errors	Number of Posttest Items	Per Cent Errors on Posttests
1	2	123	1.63
2	2	123	1.63
3	3	123	2.44
4	3	123	2.44
5	1	123	.81
6	1	123	.81
7	2	123	1.63
8	6	123	4.88
9	8	123	6.50
10	15	123	12.20

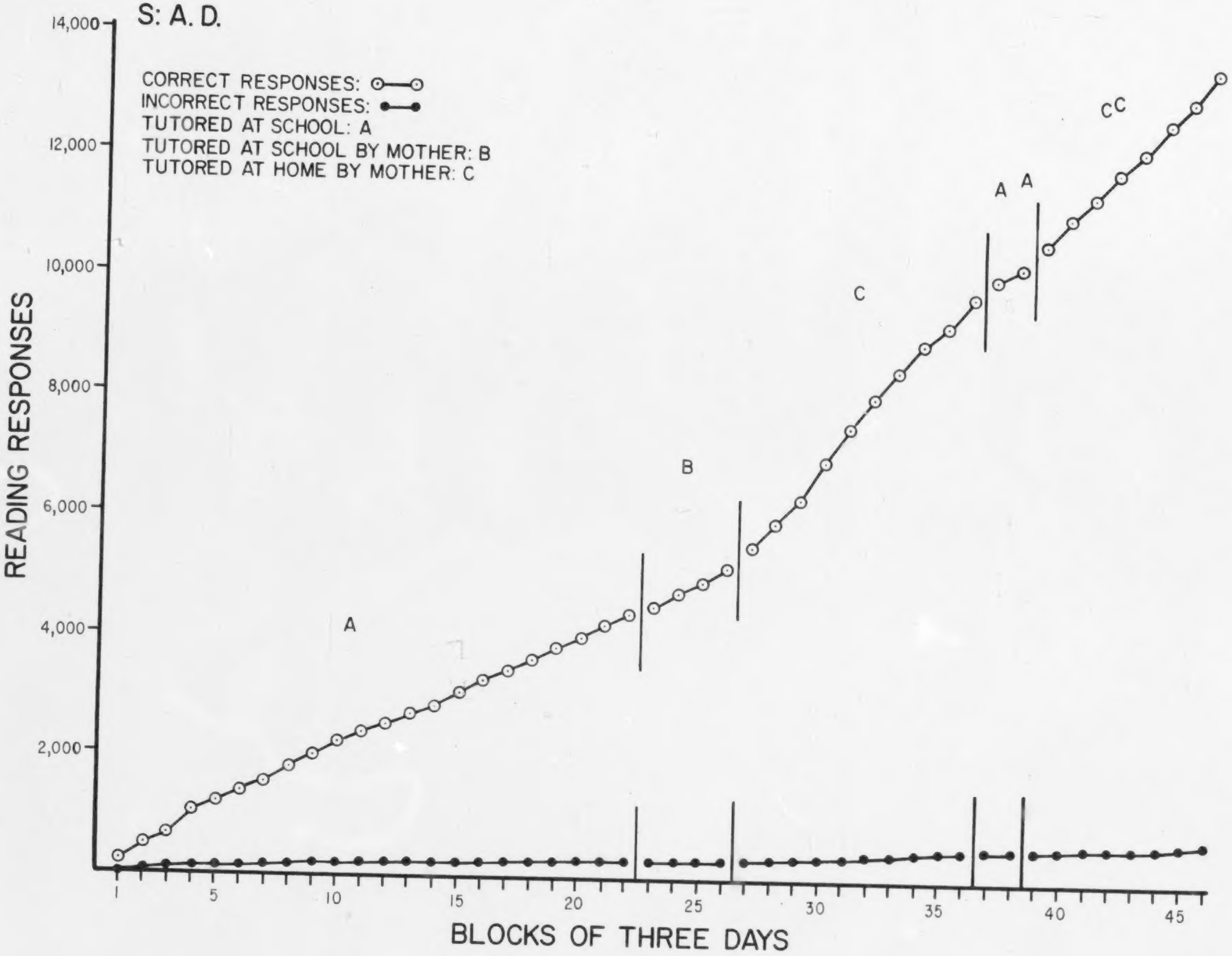
S: A. D.
CORRECT RESPONSES: ⊙—⊙
INCORRECT RESPONSES: ●—●
TUTORED AT SCHOOL: A
TUTORED AT SCHOOL BY MOTHER: B
TUTORED AT HOME BY MOTHER: C
READING RESPONSES
14,000
12,000
10,000
8,000
6,000
4,000
2,000
A
B
C
A
A
CC
1
5
10
15
20
25
30
35
40
45
BLOCKS OF THREE DAYS

Figure 7-8

tutored her son at home. His performance increase was comparable to that in the first tutoring period at home (C). At the end of 138 reading days, A.D. finished the reading program. He had made 14,168 reading responses; 13,500 were correct; 668 were incorrect. Accuracies for the various conditions are as follows: A, 94%; B, 96%; C, 96%, AA, 98%; and CC, 96%.

These data on A.D.'s achievement strongly suggest that a mother can be trained to use the IRP at home with results that significantly augment the teacher's efforts in the classroom. Reports from the mother and child also indicated that the child enjoyed working on reading with his mother.

Data on all the children's progress in reading for the 1970-71 school year are given in Table 7-4. Reading achievement is in terms of grade-placement scores on the Wide Range Achievement Test (WRAT), and on unit number in the Individual Reading Program. Comparisons of the children's scores on admission and at the end of the school year should be made in the light of the age of the child, his estimated aptitude for school achievement (PPVT scores), and length of time in the class. All of the children showed progress and the longer the time in class, the more the progress. The children who attended class for three months or less (B.B., M.K., S.M., and K.S.) showed little gains with one (K.S.), showing no change in his score on the WRAT. Three completed the program, indicated by the 263 entry under Post IRP Units.

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Insert Table 7-4 about here

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The Attending Program

The Attending Program was developed to train children who did not succeed on the IRP because they did not have the necessary precurrent attending behavior. The Attending Program serves also as a means of assessing work habits, as a pre-test for reading, as a vehicle for altering the contingencies of reinforcement, and as a background task for increasing rate of responding to verbal material. It consists of (1) a special teaching aid and graded discrimination materials, and (2) procedures that successively lengthen the interval between the presentation of a textual stimulus and an opportunity to respond. These are described more fully below.

Attending behavior is any behavior that produces or clarifies a discriminative stimulus. When a person attends, it usually means that he is focusing his behavior on something. However, many components of attending behavior are covert and are thus not directly observable. The naturally occurring overt components of attending present special problems. For instance, looking toward a presented stimulus is a

Table 7-4

Children's Reading Scores at the Beginning
and End of the Academic Year, 1970-71

Child	Age on Admission	PPVT on Admission Age	Quotient	Months in Class	WRAT Grade Placement Pre	Post	IRP Units Pre	Post
B.B.	5-10	4-7	80	1	*Kg.6	--	A**	2
C.B.	5-6	5-5	89	6	--	1.2	A	27
G.B.	5-11	5-4	91	8	Kg.8	1.6	0	163
N.B.	5-5	4-2	88	4	1.2	2.0	0	88
P.C.	8-10	7-0	83	9	1.5	1.6	130	263
A.D.	7-3	7-10	108	9	1.2	1.3	0	263
K.D.	5-9	4-11	85	9	Kg.5	1.4	A	133
H.G.	6-9	5-8	85	7	--	Kg.4	A	59
W.J.	5-3	3-10	67	4	--	1.2	A	19
M.K.	7-1	3-10	59	1	--	1.5	0	32
M.E.M.	5-8	3-7	59	8	Kg.8	1.3	0	86
M.L.M.	6-10	5-8	85	4	1.4	1.5	0	50
S.M.	5-8	4-11	85	3	Kg.2	Kg.6	A	16
K.S.	6-10	6-2	91	1	1.3	Kg.6	A	14
S.W.	8-11	7-5	86	9	1.9	2.9	50	263

*Kg. = Kindergarten
**A = Attending Program
-- = No test available

necessary condition for attending behavior, but the occurrence of this component, although easily observable, does not guarantee attending behavior. Actual eye-contact with the stimulus is a far better criterion, but completely accurate observation of the component requires prohibitively expensive instrumentation. Research with infrahumans (Eckerman, Lanson, and Cumming, 1968; Wyckoff, 1954) has shown that if an arbitrary response is required to produce a discriminative stimulus, the accuracy of discrimination is increased. The first part of the discrimination chain (i.e., attending) is made overt with this procedure.

To make the first component of attending behavior overt and observable, an inexpensive teaching aid (Figure 7-9) was developed which

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Insert Figure 7-9 about here

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required the child to manipulate cardboard masks to expose the discriminative stimulus in a match-to-sample problem. The device is made of cork-covered fiberboard 13" x 16", two manila file folders, a clear plastic page protector, a sheet of black construction paper, and two cardboard masks (3" x 4" and 3" x 8") attached to one of the manila file folders with masking tape. Assembled, the parts are fastened to the fiberboard with ½" Chicago screwposts.

Description of the Program

Discrimination levels. There are nine levels of increasingly difficult discriminations presented in three match-to-sample paradigms. Each level consists of 30 frames; levels 1 and 2 consist of punctuation marks and arbitrary symbols (e.g., #,$,*,@); levels 3, 4, and 5 are made up of upper and lower case letters. As level difficulty increases, the configurations of the distractor letters resemble more closely the correct letter. Levels 6, 7, 8, and 9 use multiple letter stimuli, with the correct stimulus always a real word. The distractors are never real words. Beginning at level 6, the distractors vary in length, initial and final letters, and configuration from the correct stimulus; by the end, at level 9, the distractors vary only by one or two internal letters. Alternate forms of levels 6 through 9 are also available. Representative frames from each level are presented below:

Level 1:	#	$	#	@
Level 2:	(	!	(	)
Level 3:	u	b	u	k
Level 4:	u	c	u	r
Level 5:	u	n	u	w
Level 6:	sun	djerfy	zxglei	sun
Level 7:	sun	sabc	erv	sun
Level 8:	sun	scx	sun	orn
Level 9:	sun	sun	suc	sgn

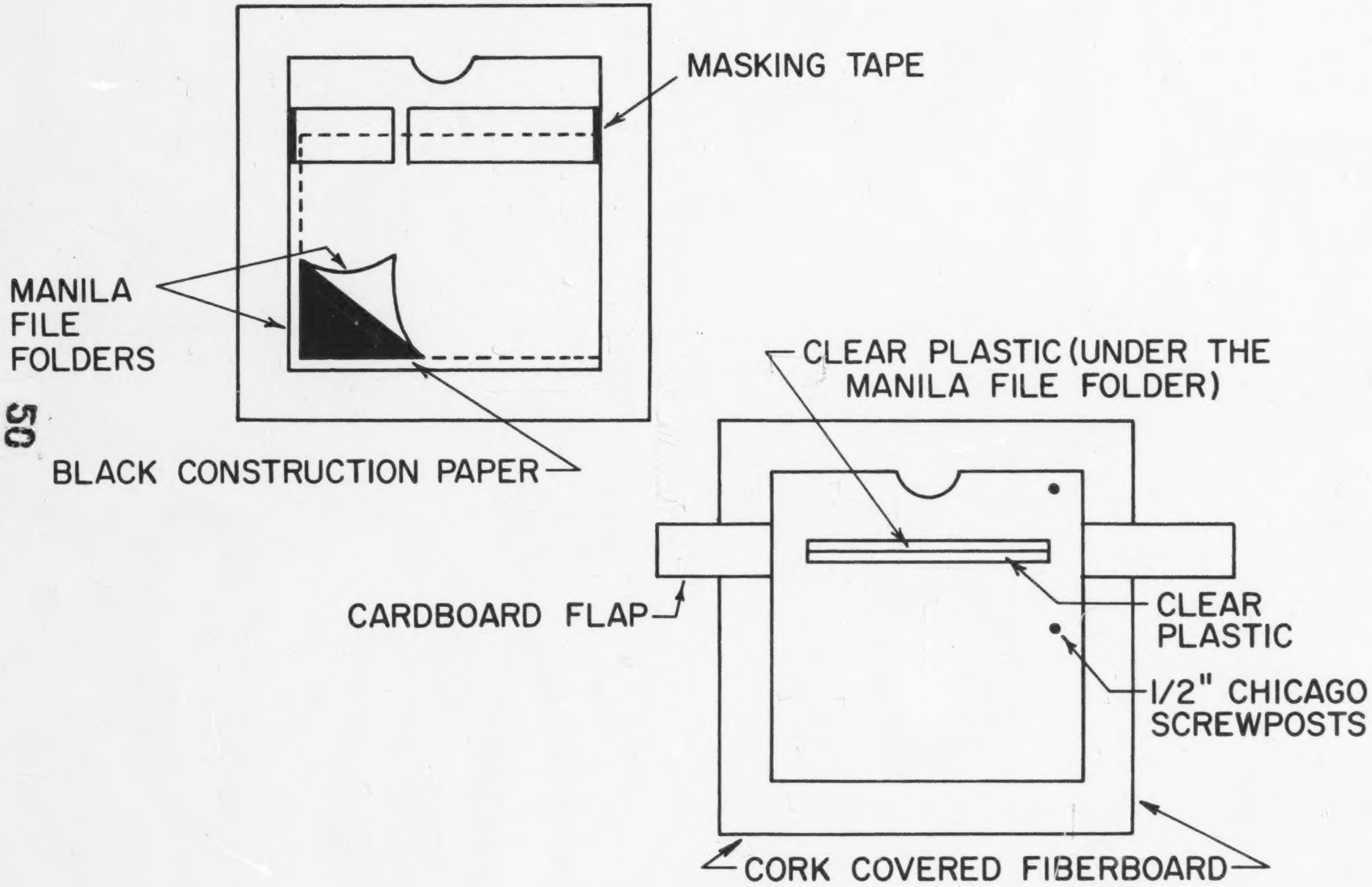
MASKING TAPE
MANILA FILE FOLDERS
BLACK CONSTRUCTION PAPER
CLEAR PLASTIC (UNDER THE MANILA FILE FOLDER)
CARDBOARD FLAP
CLEAR PLASTIC
1/2" CHICAGO SCREWPOSTS
CORK COVERED FIBERBOARD

Figure 7-9

Memory levels. There are three memory levels. The material for each of the seven discrimination levels described earlier can be used at any memory level. Level A is a simultaneous match-to-sample task. The child is shown the sample and three comparison stimuli simultaneously and is instructed to circle the comparison stimulus that matches (is just like) the sample. On level A', the sample and the comparison stimuli are also exposed simultaneously. After the child inspects all of the stimuli, the sample is covered with the cardboard mask, and the child is then told to point to or circle the one that matches the sample.

Level B is a zero-delay matching task. The sample is first presented alone, and then covered with the mark, whereupon the comparison stimuli are exposed. The child then circles or points to the match. These procedures are presented schematically below:

Level A

All | Alt All Amt
(a response to "All" is reinforced)

Level A'

All | Alt All Amt

//// | Alt All Amt
(a response to "All" is reinforced)

Level B

All | //// //// ////

//// | Alt All Amt

Use of the Attending Program

Upon enrollment in the class, the child is given discrimination levels 1 through 9, memory level A, followed by discrimination levels 8 and 9, memory level B. Regardless of his performance on the Attending Program, the child is next given the IRP General Pretest and then IRP Subset I - 1,2, introducing the words "one" and "city."

Verbal praise and mark reinforcers are given for correct responses throughout the four steps described above. If the child makes an incorrect response on the memory level B program, the tutor opens the mask covering the sample (thus making it a level A task) and prompts the child to make the correct response.

If the child's performance on IRP Subset I - 1,2 is below 80% correct, he receives tutoring on the entire Attending Program. He remains on the program until his accuracy is 95-100% on discrimination level 8-9, memory level B, and he is completing seven to nine pages per 25-minute session. In order to achieve this stable level of performance, the contingencies of reinforcement are systematically tightened. Whenever the child makes an error on a page of work, the tutor uses the appropriate correction procedure including having the child re-do the page from the beginning. It is a further requirement of the program that the last page completed in the session be errorless.

Development of the Program

The child for whom the initial Attending Program was improved and expanded was K.D., a five-year-old girl who had been referred because of a total lack of progress in kindergarten. Figure 7-10 shows her performance on the reading program before and after mastery of the Attending Program. The data points represent overall accuracy (listening comprehension, reading discrimination, read back, and reading comprehension) per reading session. The dotted line at 90% represents the criterion for mastery on the reading program. In September, at the beginning of the school year, following her successful completion of the memory level A Attending Program (simultaneous match-to-sample with textual stimuli), K.D. was placed in the reading program at Subset I - 1,2 for 10 sessions. When she failed to master that material, it was reprogrammed on a daily basis. However, this strategy did not improve her performance but produced, over the last three sessions, a low of 25% correct responding. This is below chance for the reading discrimination task.

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Insert Figure 7-10 about here

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K.D. was then given sections of the memory level B Attending Program (zero-delay match-to-sample) at which point it became obvious that she could not do any of the required tasks. An intermediate level, memory level A', was then developed as a bridge between levels A and B. Given the new material, K.D. was able to respond accurately at the lower discrimination levels and successfully worked through level A' and level B when she was given IRP Subset I - 1,2. The first data point in the October-November series of Figure 7-10 represents K.D.'s reading performance following training on the Attending Program. She continued to work on successive IRP subsets obtaining over 90% accuracy on all but three of the sessions in October-November. The April points in Figure 7-10 indicate that K.D.'s performance remained stable after six months on the reading program and that the variability of her performance decreased from what it had been in October-November.

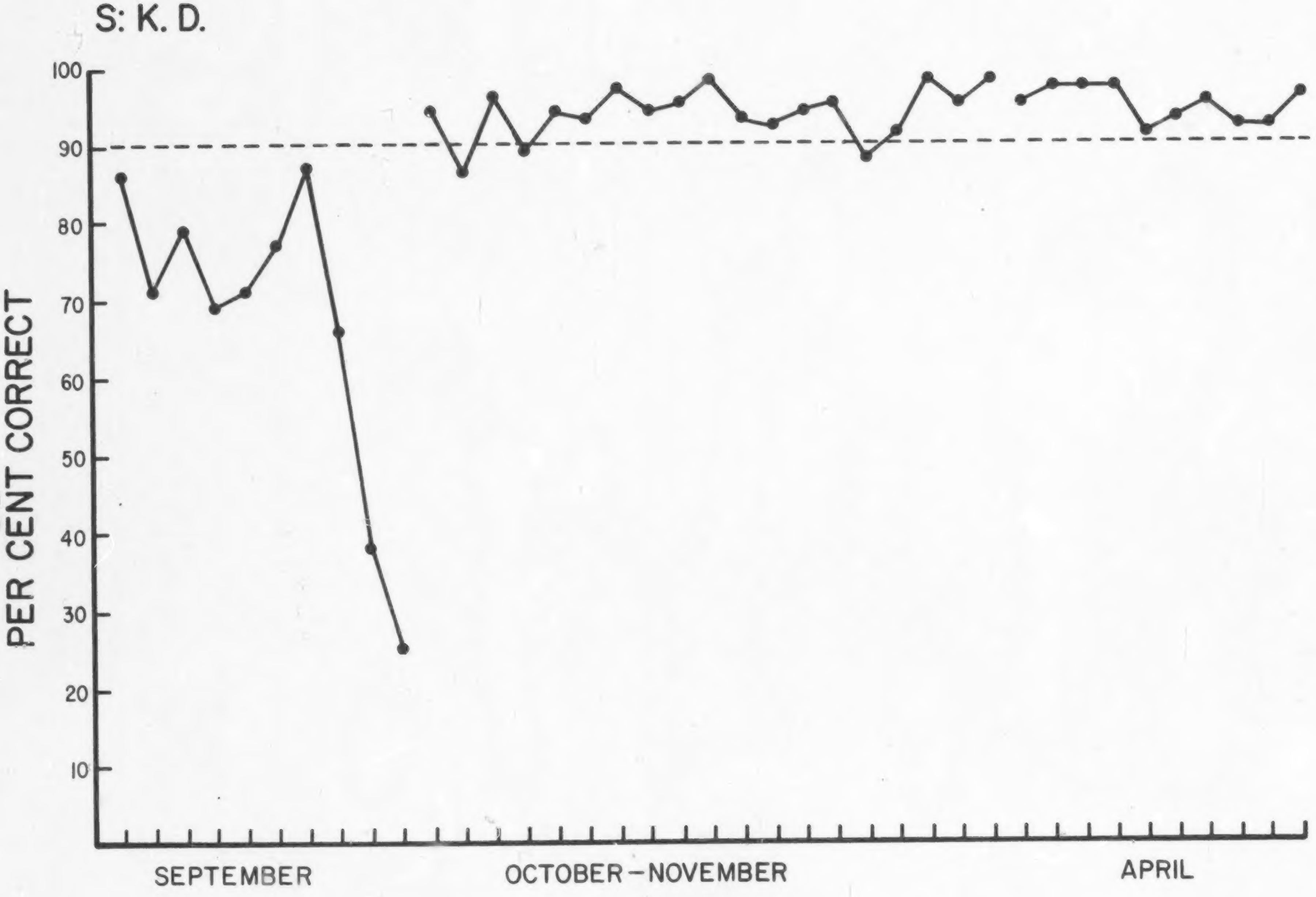
S: K. D.
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
SEPTEMBER
OCTOBER – NOVEMBER
APRIL
SESSIONS

Figure 7-10

By the time S.M. was enrolled in the class, the Attending Program was well developed and had been used successfully with three children. S.M., a five-year-old girl, was referred because she failed to make progress in the regular kindergarten class. Figure 7-11 represents her performance on the Attending Program. Memory levels A and B were used as a pretest for the reading program. The pretest data show that S.M.'s discrimination accuracy broke down at discrimination levels 8 and 9 on both memory levels A and B. S.M. was then put to work and given the first IRP subset for two sessions, and when she failed to reach the mastery criterion, she was given the full Attending Program in order to pinpoint her current level of discrimination competence. The exploration data in Figure 7-11 show that her performance broke at discrimination level 9, memory level A', and discrimination levels 8 and 9, memory level B. This small improvement in the memory level A pretest results may be accounted for by the learning that took place on the carefully sequenced discrimination materials.

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Insert Figure 7-11 about here

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During the training portion shown in Figure 7-11, S.M. was given only discrimination levels 6, 7, 8, and 9, memory level B, of the Attending Program. In this phase, the reinforcing contingencies were systematically tightened and, if she made an error on any page, she was required to start again at the beginning of the page and re-do it. She was expected to complete a pre-determined number of new pages during each session, and remained at the task until she finished. The results of this training are shown in Figure 7-12. Again, the data are the combined scores across days for the four basic reading tasks. The first two points show her scores before the attending training phase was begun; the others after training. Figure 7-12 shows that following the Attending Program, S.M. made satisfactory progress in the reading program with variability typically decreasing across sessions. The same data are shown separately for each reading task in Figure 7-13.

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Insert Figure 7-12 about here

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- - - - - - - - - - - - - - - - -

Insert Figure 7-13 about here

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It can be seen that both reading discrimination (RD) and read back (RB) performances were less stable than either of the comprehension tasks. The larger number of data points for RD and RB as compared with listening comprehension (LC) and reading comprehension (RC) indicate that S.M.

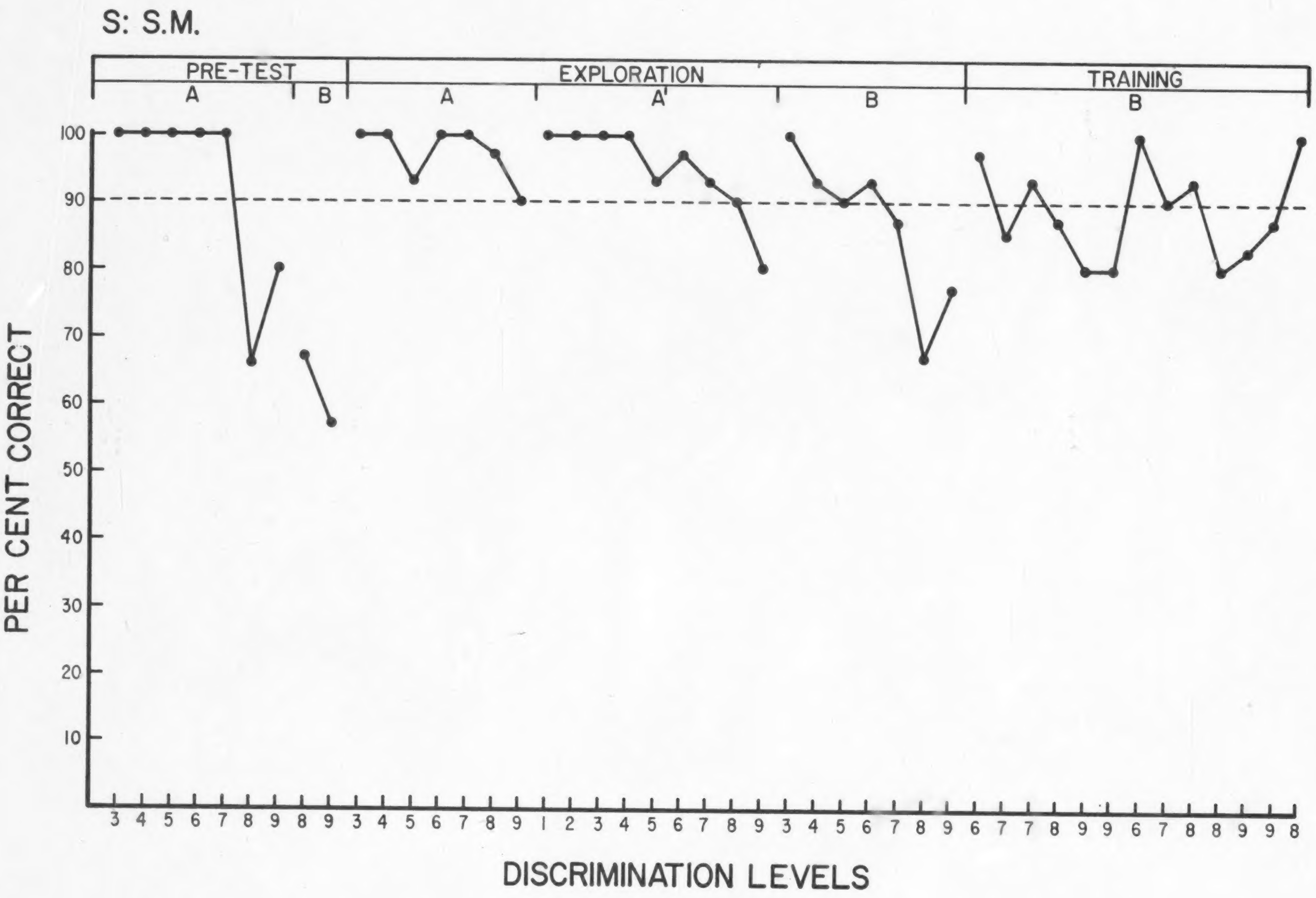
S: S.M.
PRE-TEST
EXPLORATION
TRAINING
A
B
A
A'
B
B
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
3 4 5 6 7 8 9 8 9 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 3 4 5 6 7 8 9 6 7 7 8 9 9 6 7 8 8 9 9 8
DISCRIMINATION LEVELS

Figure 7-11

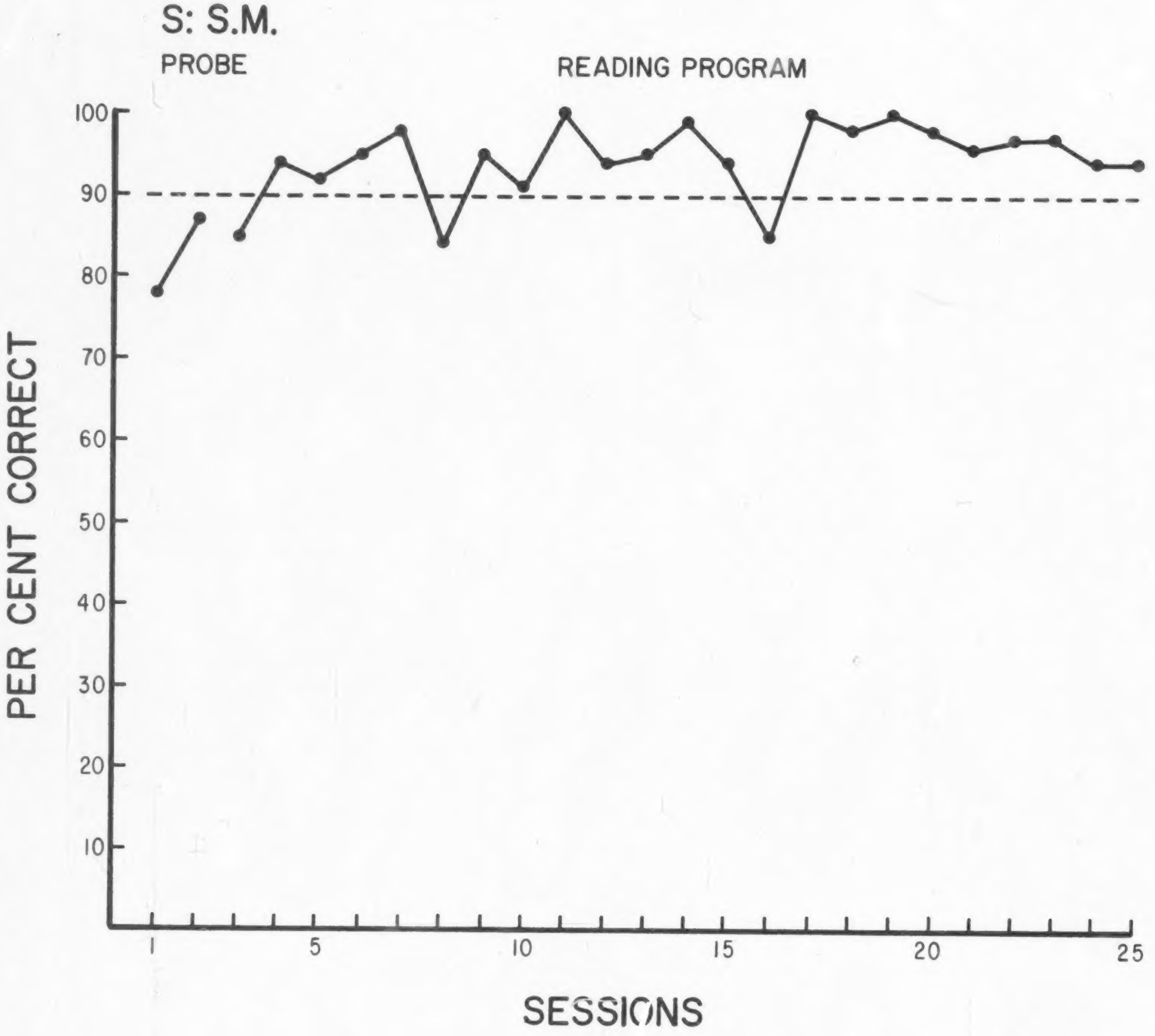
S: S.M.
PROBE
READING PROGRAM
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
SESSIONS

Figure 7-12

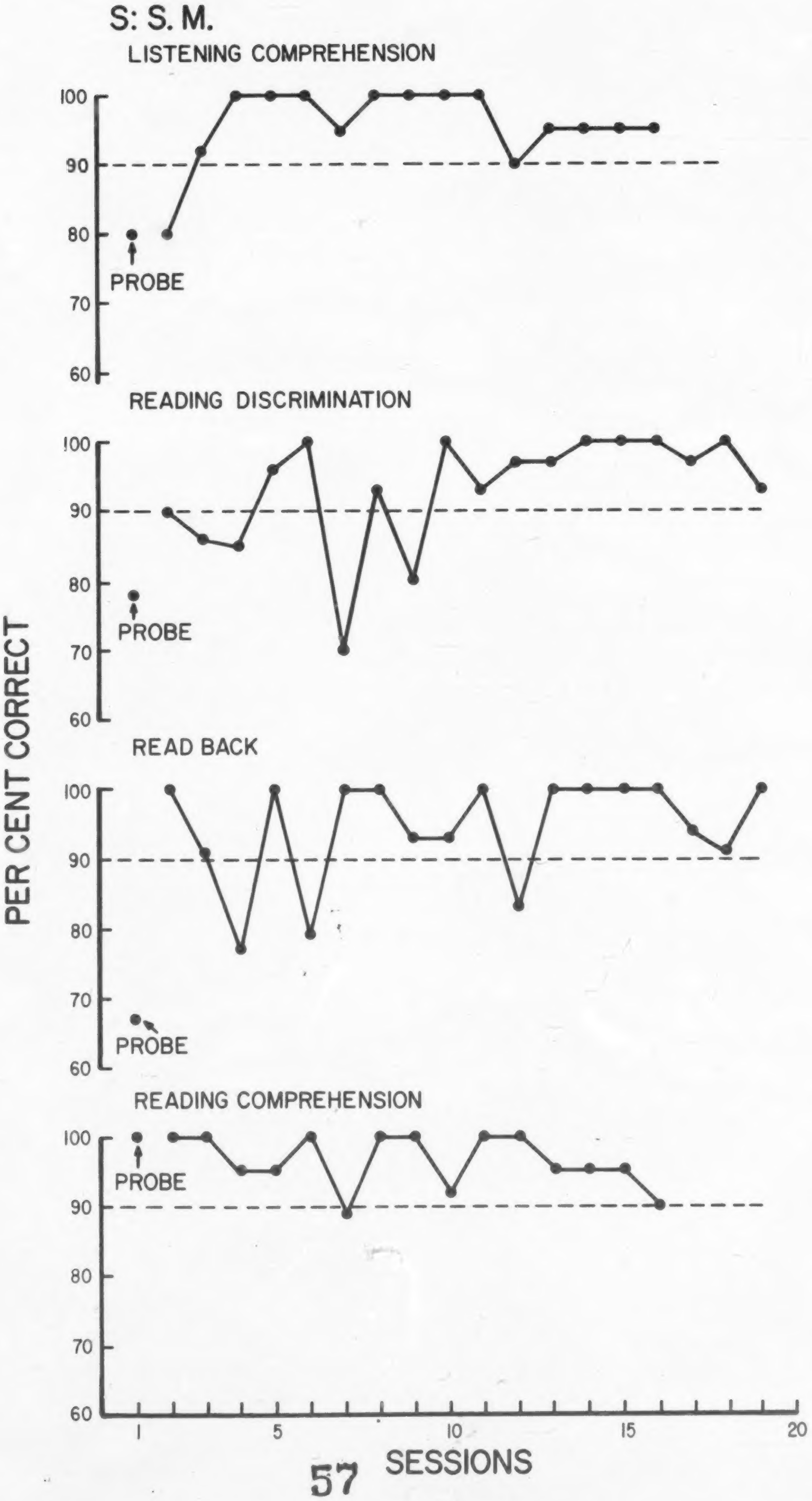
S: S. M.
LISTENING COMPREHENSION
100
90
80
70
60
PROBE
READING DISCRIMINATION
100
90
80
70
60
PROBE
READ BACK
100
90
80
70
60
PROBE
READING COMPREHENSION
100
90
80
70
60
PROBE
PER CENT CORRECT
1
5
10
15
20
SESSIONS

Figure 7-13

was assigned remedial units to do when her performance fell below the 90% mastery criterion.

The final major development in the Attending Program occurred after the child, C.B., was enrolled in the class. C.B. was a five-year-old girl who had had a neurological impairment of unknown etiology at the age of five weeks. She developed a hydrocephalus which was arrested by a shunt. Neither her preschool or kindergarten teacher had been able to teach her the names of the colors, the days of the week, numeral recognition and naming, or letter recognition and naming. When she entered the Laboratory school, C.B. was pretested with discrimination levels 8 and 9, memory level B of the Attending Program. The results indicated that she could not discriminate groups of letters. She was then given the first subset of the Individualized Reading Program. Her performncce on this task which was far below the mastery criterion is shown under B in Figure 7-14.

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Insert Figure 7-14 about here

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The full Attending Program was administered next. Procedures were identical to those described previously for S.M. Although C.B. was normally an unusually friendly and placid child, she began soon after admission to the class to display emotional behavior such as crying and mildly destructive behavior toward materials and equipment. These behaviors were extinguished in the context of the Attending Program and she progressed successfully through all the discrimination and memory levels. Initial IRP subsets were again administered (see D in Figure 7-14) and, although early results were encouraging, her performance deteriorated after a few sessions. C.B. was then given discrimination levels 8 and 9, memory level B for one session. Her accuracy was 100% on this task.

It was obvious, then, that there was a gap between the upper levels of the Attending Program and the beginning of the reading program in that, at least for one child, performance on the Attending Program could be perfect and performance on the IRP could be poor. The following procedure was then developed to bridge that gap. The reading discrimination task was programmed as a zero-delay match-to-sample task (memory level B on the Attending Program). One sample is presented below.

city   dfgeano   city   mnrshol

The teacher first pointed to the sample stimulus, "city," and said, "This is 'city'. What is it?" After C.B. had imitated the auditory stimulus, the teacher asked her to cover the sample, expose the choices, and circle the correct word. In the next frame, presented below, the

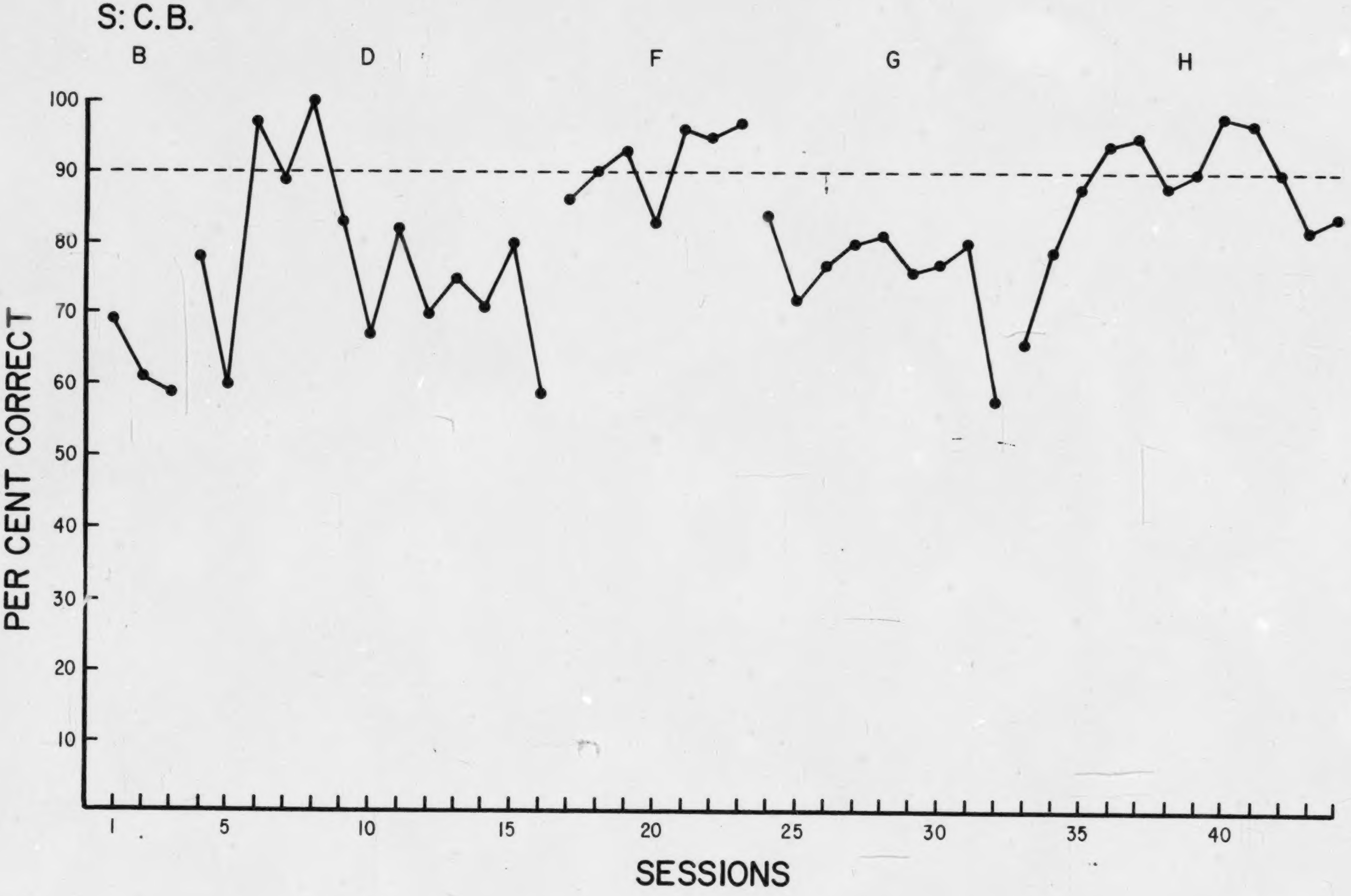
S: C.B.
B
D
F
G
H
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
30
35
40
SESSIONS

Figure 7-14

teacher pointed to the sample

city nr city fmnaoh

and said, "What is this?" If C.B. said the word, the teacher reinforced her and programmed the rest of the zero-delay trial. If C.B. gave an incorrect response, the teacher said, "This is 'city'. What is it?" and programmed the rest of the zero-delay trial. This procedure was successful and after two sessions, C.B. was again given the regular reading program.

Figure 7-14 (F) shows the child's performance on the next six reading sessions (each session introducing a new word). On four, C.B. scored above 90% accuracy and on all six, above 80% accuracy. Figure 7-14 (G) shows C.B.'s performance with a reversal of the contingencies of reinforcement. Under this condition, her previously accurate reading behavior deteriorated. When the original contingencies were reinstated, however, C.B.'s reading accuracy recovered steadily (H in Figure 7-14).

C.B.'s performances on the components of the IRP are shown in Figure 7-15. As can be seen, performance on the constructed tasks (Read Back and Reading Comprehension) is affected more adversely by the reversal of reinforcement contingencies than performance on the discriminated task (Reading Discrimination).

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Insert Figure 7-15 about here

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Figure 7-16 is a cumulative record of C.B.'s work rate (i.e., frames completed per day) on the entire Attending Program and IRP materials. Portions of the record labeled A, C, and E represent progress on the Attending Program; G is the reversal of the contingencies of reinforcement. It is readily apparent that C.B.'s rate steadily increased across the 94 days she was on the program. This was due in large measure to C.B.'s increased self-sufficiency, adeptness at manipulating the academic materials, and absence of emotional behaviors that are incompatible with academic achievement.

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Insert Figure 7-16 about here

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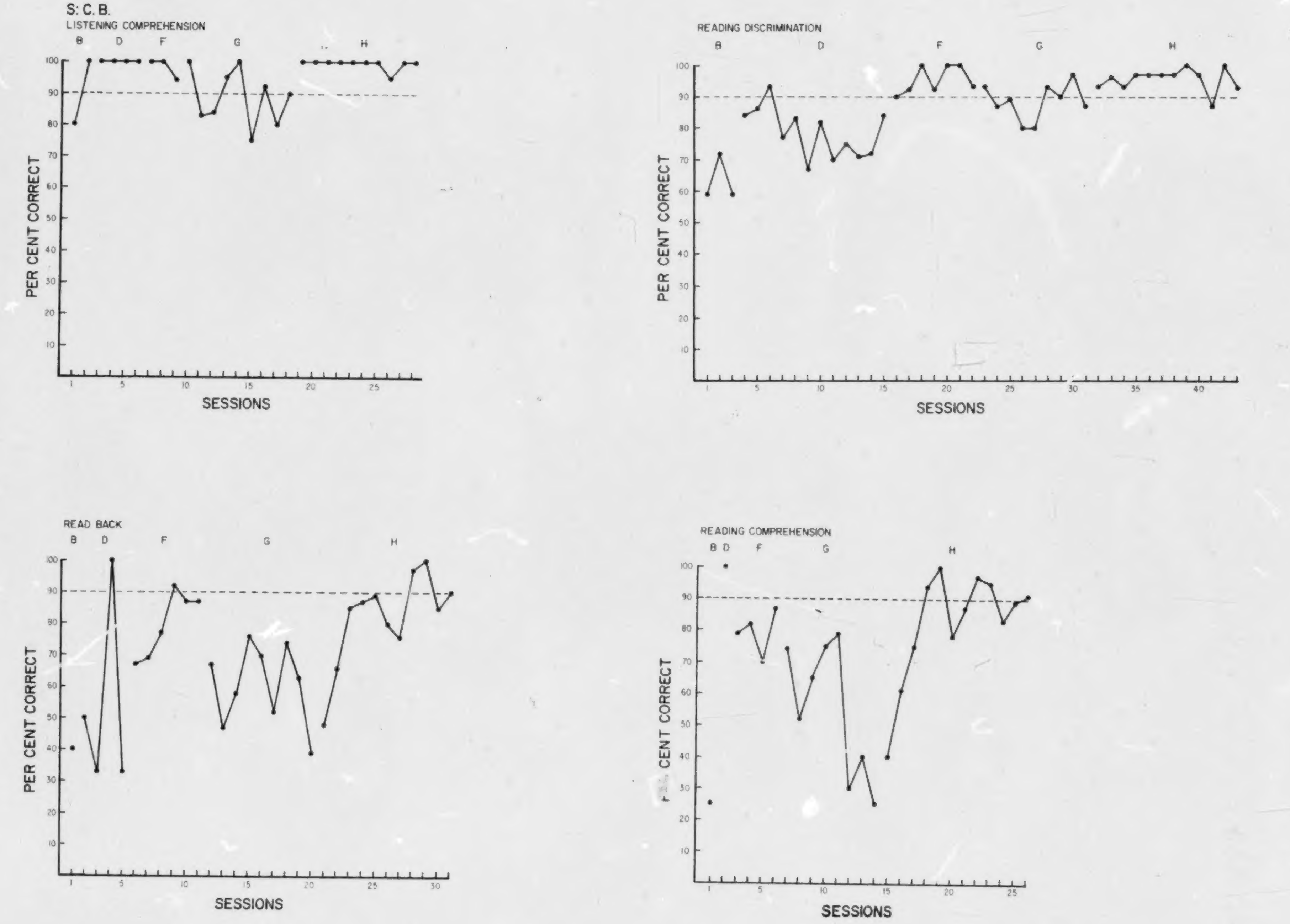
Data on 10 children who completed both discrimination level 9, memory level B of the Attending Program, and the first subset of the


S: C. B.
LISTENING COMPREHENSION
B
D
F
G
H
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
SESSIONS
READING DISCRIMINATION
B
D
F
G
H
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
30
35
40
SESSIONS
READ BACK
B
D
F
G
H
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
30
SESSIONS
READING COMPREHENSION
B D
F
G
H
PER CENT CORRECT
100
90
80
70
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40
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20
10
1
5
10
15
20
25
SESSIONS

Figure 7-15

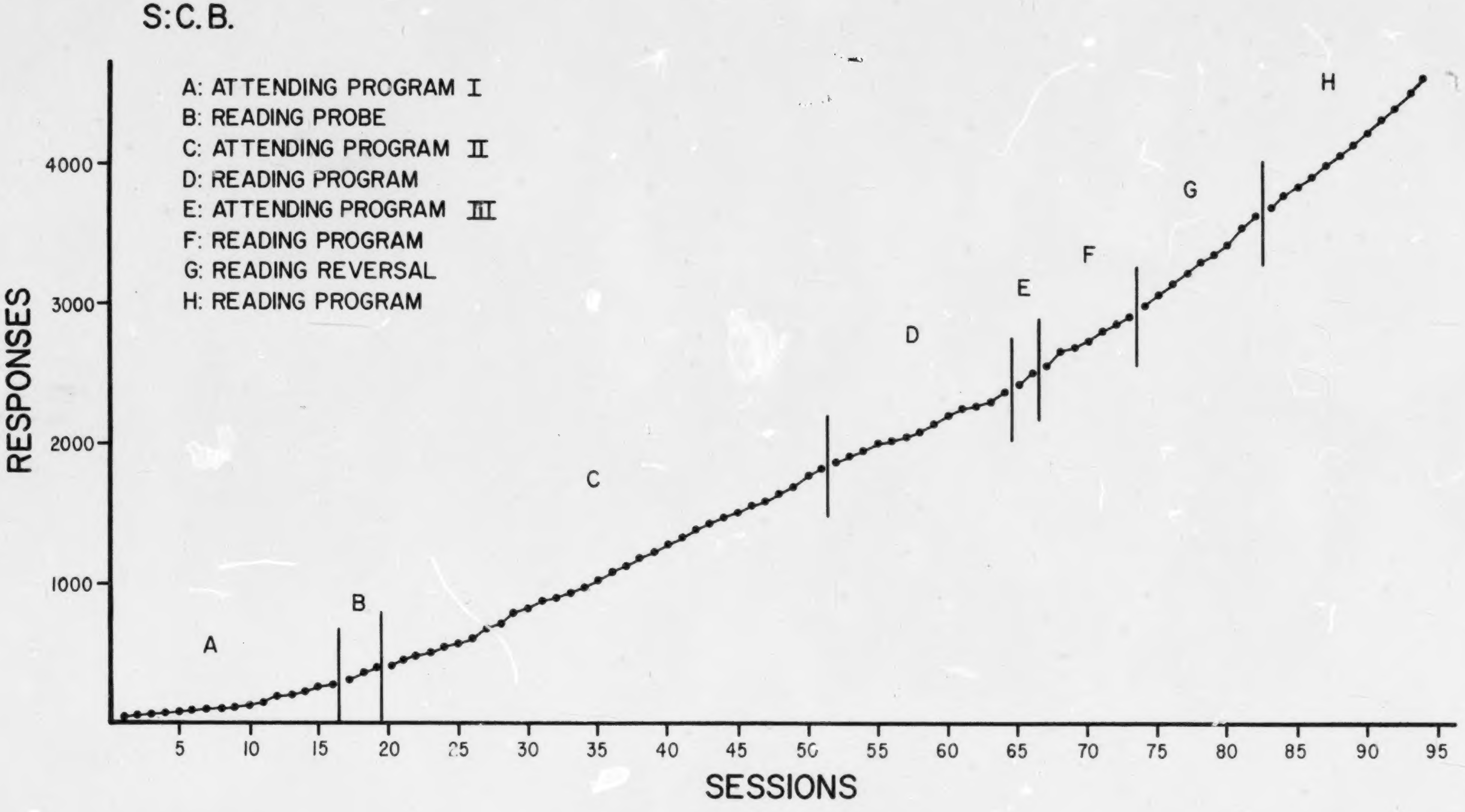
S:C.B.
A: ATTENDING PROGRAM I
B: READING PROBE
C: ATTENDING PROGRAM II
D: READING PROGRAM
E: ATTENDING PROGRAM III
F: READING PROGRAM
G: READING REVERSAL
H: READING PROGRAM
RESPONSES
4000
3000
2000
1000
SESSIONS
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
A
B
C
D
E
F
G
H

Figure 7-16

Individualized Reading Program are presented in Table 7-5. Without

- - - - - - - - - - - - - - - -

Insert Table 7-5 about here

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exception, children who could not perform at the 90% accuracy level on this limited portion of the Attending Program subsequently failed to acquire the appropriate reading behaviors on the first IRP subset. The three children who performed well on the attending task also performed well in reading, although none of them could read at admission to the class and none was exposed to much of the Attending Program. The seven children who were below criterion on the first IRP subset were given the complete Attending Program and all performed well on the first and succeeding subsets of the reading program. Thus, the Attending Program proved to be a reliable predictor of reading success (discrimination level 9, memory level B is now used as a pretest for reading) and a useful remedial technique for children who have difficulty with reading because of deficiencies in attending behavior.

Table 7-5

Relationship Between Performances on the Attending Program and the Individualized Reading Program

Child	Attending Program Discrimination Level 9 and Memory Level B Accuracy	IRP Subset 1-1.2 Accuracy
K.D.	20%	55%
B.B.	60%	71%
H.G.	40%	64%
W.J.	80%	81%
S.M.	60%	81%
K.S.	20%	81%
C.B.	40%	54%
N.B.	100%	98%
M.L.M.	100%	95%
M.K.	100%	98%

C. The Arithmetic Program

Introduction: A Behavior Analysis of Arithmetic

Arithmetic performance consists of behavior primarily under the control of stimuli, both visual and auditory. The stimuli include numbers and operation symbols (+, -, ÷, etc.) whose functions are determined by whatever arithmetical problems require solution, or as they would be described technically, by the contingencies of reinforcement arranged by society. Arithmetic behavior, at an elementary level, involves discriminated (selecting) and constructed (saying and writing) responses to numbers and operation signs and responding to combinations of these stimuli according to rules (e.g., adding numbers when there is a plus sign, subtracting one number from another when there is a minus sign).

Merely defining the topography of arithmetic behavior, however, is insufficient. It must be viewed in functional terms, i.e., with respect to the independent variables that control the behavior. It is not enough for a pupil to say "seven," he must say "seven" when he is presented with the proper textual stimulus, namely 4+3, 9-2, 49÷7, etc. Simply performing the correct topography is not "knowing" how to do arithmetic.

The range of verbal behavior called arithmetic extends from discriminating one symbol from another of the symbols to problem solving (complex chained responses which modify the situation so a solution is available). This latter category includes responses of transposition, reduction, construction of equations, finding common denominators, and use of complex arithmetical processes such as calculus.

Besides the obvious differences between arithmetic and other verbal repertories, we can isolate some general characteristics which may facilitate the application of learning principles to the teaching of elementary arithmetic. Since arithmetic is verbal behavior, it will be necessary to consider the interactions among the pupil, the teacher, the setting, and the material as the functional unit of analysis. The main task of the teacher is to arrange as many of the conditions as she can. An effective teacher, for example, will supply antecedent stimuli which will function to produce correct responses, set general conditions conducive to productivity and put consequences on behaviors which will strengthen and maintain them.

For simplicity of explanation, arithmetic will be compared with reading. One quantative difference between reading and arithmetic is the frequency with which contingencies are arranged by society. Excepting the use of numbers as markers (e.g., a telephone number, a social security number), the actual manipulation of numbers using mathematical operations is minimal outside of school classrooms. Machines have taken over much of the labor of arithmetic (cash registers, calculators, computers). Reading has not enjoyed the same "advancements."

There are everyday "natural" contingencies for reading, but arithmetic is most often maintained by the solving of problems irrelevant to everyday survival. At more complex levels of mathematics (e.g., algebra, trigonometry, calculus) these behaviors are almost exclusively maintained by solving more complex problems. Aside from the question of whether or not non-maintained behaviors should be taught in school, it is certainly desirable to maintain arithmetic behaviors with functional contingencies rather than those inherent in arbitrary problems. For example, addition and subtraction could be incorporated into money values and time telling, or arbitrary problems could be transformed into a "story problem" format. This would not only make arithmetic more "natural" by tying it to non-arithmetic situations, but it should make correct solutions more reinforcing. It is also essential that the necessary precurrent behaviors for the learning of arithmetic be strengthened to the point where they are functional for solving arbitrary problems.

The second basic difference between reading and arithmetic is that words, phrases, and sentences have a referent. Arithmetic, on the other hand, is composed of a set of arbitrary symbols referring only to an abstract property of observables. The comparison becomes more clearcut when we consider extremely large, small, or undefined numbers. Since it is easier to match constant stimuli, it would seem desirable to develop a systematic observable equivalent to auditory and visual numbers which would act as a prompt and could be faded later to allow for generalization. Finger counting is such a system; it provides a readily available physical equivalence which the pupil can manipulate when prompts are required. In fact, the system is so effective it can be troublesome if control is not gradually transferred to the number stimulus alone (e.g., adults who still use fingers to add). Generalization of arithmetical behavior requires reinforcing responses to: (1) other objects in number sets, (2) abstractions of objects (pictures), (3) oral and textual descriptions (e.g., "three cows" or "17 houses") and (4) the oral or textual number with no observable referent (e.g., 2 and 3). These operations are performed in the present arithmetic program by using dots, numbers, and sets. The sequence, however, is in reverse order - a child goes from number recognition to working with dots, numbers and sets, and then to finger counting.

The third difference between arithmetic and reading is based on the fact that arithmetic operations can be performed on any number at any time. For example, two numbers can be added, subtracted, divided, or multiplied. With transformations and the inclusion of negative numbers, the range of responses possible is indefinite. A sentence in reading is analogous to an equation in arithmetic. While some freedom is exercised, the structure of a sentence is defined within relatively narrow limits. On the basis of this difference, teaching of arithmetic should provide the child with many opportunities to develop the fine stimulus control indicated by the operation signs. Programs should be designed so that the different operations such as addition and subtraction are introduced nearly simultaneously, thereby making signs functional from the beginning of training. It would be consistent with learning principles to require an overt attending response to the operation sign prior to training in arithmetical problem solving. With proper sequencing of material, a chain would develop in which attending to the operation sign would be maintained as a strong functional precurrent response.

The fourth difference lies in the natural sequence and relational characteristics intrinsic to reading and arithmetic. The number sequence (1,2,3...) is an orderly arrangement which is functional for problem solving. The arrangement of letters is essentially arbitrary since the specific arrangement has no functional relation to the independent controlling variables. To put it another way, numbers may have nominal, ordinal, interval, and ratio characteristics. Reading's counterpart, the alphabet, may be nominal or ordinal but this serves no direct function for reading. For example, the response "2" is the proper response for an infinite number of stimuli (e.g., 1+1, 3-1, $\sqrt{4}$, etc.), while words have a limited number of stimuli to which a response results in reinforcement from the verbal community. This fact emphasizes the necessity of bringing the same response under an extensive range of stimuli. It is also possible to incorporate the use of verbal chaining of a number into algorithms for addition and subtraction operations as in the present program.

The fifth difference between arithmetic and reading is the size of the repertory of these responses when a child enters school. Reading is a textual system in which the existing responses are brought under the control of textual stimuli. Arithmetic, on the other hand, has fewer contingencies programmed at the auditory level so that children entering school have fewer numbers and operations in their listening and speaking vocabularies. It would follow that it would be easier to bring behavior under the control of textual stimuli if initial stages of the program allowed the child to respond orally. It may be desirable to first arrange contingencies so that responses come under the control of objects (finger counting and dots) with number recognition occurring after the child is making responses to the auditory and object stimuli.

Summarized, the sequence would be as follows:

1. Vocal imitation of numbers
2. Vocal chaining of numbers
3. Object counting to 10 from an auditory stimulus
4. Finger counting to 10 from an auditory stimulus
5. Matching dots to dots
6. Matching numbers to numbers (discrimination test of textual stimuli)

7. Forced choice, matching dots to numbers

8. Matching dots to numbers

9. Finger counting as an addition algorithm, i.e., method of computing

Tasks seven and eight require the child to produce a self-prime for naming the number and a self-prompt for the matching response. The child not only proceeds from a constant physical referent to the number, but responds to oral and three-dimensional stimuli before more difficult two-dimensional textual stimuli. Discriminated responses also precede constructed responses.

Description of the Arithmetic Program

The Arithmetic Program is composed of three major classes of arithmetic behavior: pre-arithmetic, addition, and subtraction. Each class is divided into units with further divisions into (1) pretests to assess the child's entering repertory, (2) teaching techniques and programmed sequencing to teach the responses specified in the objectives, and (3) evaluations to determine whether the child has acquired the behaviors programmed.

Terminal Behaviors and Pretests

Each sequence has an objective which specifies the topography, setting conditions, discriminative stimuli, and accuracy criteria which the response must satisfy before the behavior is considered acquired. The mere specification of topography is insufficient. "Knowledge" or "meaning" is not inherent in topography but is the specification of the behavior in its interaction with the controlling independent variables.

Administration of a programmed sequence is typically preceded by a pretest to assess the child's arithmetical repertory. Pretesting is essential because it provides information on (1) the current repertory for overall post-evaluation of the program's effectiveness, (2) the current repertory for optimal placement within the program, thereby eliminating training on material the child already knows and at the same time assuring training in all terminal and prerequisite behaviors, and (3) placement at a level in the program where he can respond correctly at a high rate and thus receive adequate reinforcement to sustain his behavior.

As each child enters the program, his teacher administers a general pretest covering behaviors up to and including terminal addition units. In addition to the general pretest, most units of the program have pretests specific to the prerequisite responses and terminal behaviors for that unit. Data have shown, however, that once children begin the addition program the sequence is such that few children have skills above the unit at which they started.

Teaching Techniques and Program Sequencing

Teaching techniques. Concurrent with instruction in arithmetic, it is necessary to strengthen certain non-arithmetical responses through the use of social and token reinforcement. These responses include going to a study area without unnecessary delay, having the essential materials, sitting in a position to perform the task, and attending to the materials.

To increase precurrent attending, a teacher might change the mode of presentation or modify materials to evoke the child's attention (e.g., isolate materials, move materials about erratically, use audio-visual devices for presentation, etc.) but such procedures do not improve attending behaviors. If anything, they tend to make it more difficult to attract and maintain good attending behavior. Behaviorally speaking, attending is a two-part chain where the first response(s) (precurrent) increases the probability of a correct arithmetical response. The terminal reinforcer strengthens all responses - attending presents (or makes available) the discriminative stimulus for reinforcement of the solution). This discriminative stimulus acquires a conditioned reinforcing function and maintains attending behaviors. Good teaching involves the strengthening of all links in the chain until the reinforcer at the end (given for a correct response) is sufficient to maintain the complete chain.

The use of primes and prompts. Once the behaviors have been specified and the child has entered the program with an adequate attending repertory, the teacher is faced with the problem of how to evoke the correct arithmetic behavior so it can be reinforced. Several options are open to the teacher. She can simply wait for the response to occur, which is highly unlikely; she can selectively reinforce closer and closer approximations of the terminal response (shaping); or she can evoke the response by using a prime. A prime is a stimulus which brings out reluctant responses (e.g., imitation, instructions, etc.). Because of the limited number of discrete responses required in this program (i.e., 1 through 20, +, -, and =), the teachers generally use imitation as a priming technique. The remainder of the arithmetic program involves helping the child to bring arithmetical responses under control of special verbal stimuli. Since a primed response is under irrelevant stimulus control, the prime is removed so that the terminal arithmetic behavior satisfies the objective of the arithmetic program. Sheer repetition of a response (drill), primed or not, does not lead to acquisition of the response. Learning occurs because the response is reinforced.

Removal of primes while bringing the response under relevant stimulus control is achieved by the use of prompts. Prompts are fragments or primes. While a prime will evoke a response with minimal conditioning history, a prompt will evoke the response only if other variables have already acquired some stimulus control. Prompting is the addition of a stimulus to a terminal stimulus (frame) in order to increase the probability of a correct response. Prompts vary in their ability to maximize correct responding and are faded by the teachers from strong to weak as instruction proceeds. When high error rates occur, teachers strengthen prompts; as the child comes under stimulus control, the teacher gradually eliminates prompts. The terminal frames, or the "test" of objective mastery have no prompts.

Prompts are divided into three categories: (1) Formal prompts which add stimuli which, in turn, provide information about the form of the response (a formal prompt for 7 might be the /s/ sound); (2) Thematic prompts, which through added contextual stimuli, provide information on the "meaning" (a thematic prompt for 4 might be, "We celebrate Independence Day in July."); and (3) Sequence prompts, which because of a number of frames with the same solution response, increased the probability of the correct (identical) response.

Sequencing of steps. Basic to the use of primes and prompts is the principle that one should never ask a pupil to do what he cannot do. In conjunction with primes and prompts, terminal arithmetical behaviors are approached in gradual steps. Step size refers to the functional difference between the consecutive stimuli to which the child must respond. Small steps minimize errors, keep reinforcement within the pupil's reach, and allow each component of the terminal behavior to enter into a contingency.

In order to assure sustained activity on the part of the child, and to further maximize the probability that each response the child makes is correct, the arithmetic program as a whole, and unit sequences, as well, are composed of small steps. Each step in the unit programs must be mastered before the child advances to the next, since most units of work depend on mastery of previous units.

By using a sequence derived through empirical analysis (responses of the child), the teacher provides the child with materials to which he can respond correctly; and through supplementary thematic, formal, and sequence prompts and the fading of such prompts, the child acquires arithmetical skills.

In the event of a high rate of errors, remedial sets and procedures are introduced. The revisions aim to (1) eliminate confusing and/or incorrect frames; (2) decrease the rate at which prompts are faded; (3) reassess the prerequisite behaviors; (4) evaluate subsequent remedial programs; and (5) assess the subsequent correction of nonfunctional contingencies of reinforcement.

Managing contingencies of reinforcement. When possible, the child is encouraged to work independently, receiving reinforcement and corrections as necessary to maintain steady work rates and accuracy. It is a well-known principle of learning that a child progresses most rapidly in a task when each response is reinforced, but that such a schedule is likely to lead to satiation of the reinforcer, and is also likely to lead to rapid extinction of the response when the reinforcer is not forthcoming. For these reasons, it follows that, initially, each response to the arithmetic material is reinforced with praise and a mark. As the child progresses in the program, the schedule of reinforcement is "thinned," thereby decreasing the amount of child-teacher interaction while maintaining high rates of correct performance. This procedure also forestalls satiation and extinction. Some units require constant tutoring, others require monitoring only upon completion of entire sequences.

Managing incorrect answers. Errors are dealt with immediately in a way that tends to eliminate similar responses in the future. Essentially, the teacher pauses following the child's incorrect response and says, "The answer is _______." The problem is then presented again. If the prime or prompt used is inadequate, the procedure is repeated with stronger prompts. If the error occurs on a terminal item, then this frame is repeated later without a prompt. When a child is not engaging in either precurrent or arithmetical behaviors, he is systematically ignored (put on extinction). As soon as the child returns to "on-task" behaviors, he is reinforced socially and prompted to continue with the problems. Severe disruptive behaviors (those satisfying the time-out criteria) are followed immediately with a period of removal from opportunities to receive reinforcement.

Components of the Arithmetic Program

Pre-arithmetic. The pre-arithmetic component consists of 8 units with 21 subsets. These sequences are designed to (1) evoke arithmetical responses through the use of imitative prompting procedures; (2) provide training in number chaining, (3) provide training in discriminated and constructed responses to written numbers, objects, and representations of objects; (4) give training in precurrent attending behaviors, and (5) provide a precurrent problem-solving chain for algorithmic solutions to addition problems.

After completion of the pre-arithmetic sequences, the child is able to correctly and reliably:

1. Imitate the numbers 1 through 20 orally presented in random sequences by the teacher.

2. Count aloud from any starting number (e.g., 3, 7, 15, etc.) to 20.

3. Identify (name and point to) written numbers to 20.

4. Count aloud a number of three-dimensional objects (blocks) equal to (a) an exact model, (b) an orally presented number, and (c) a written number.

5. (a) Count out and circle a set of planometric stimuli (dots) to match an exact model, (b) count out and circle a set of dots to match a textual number, and (c) circle a textual number equal to a set of planometric stimuli.

6. Orally and "physically" count sequentially a given number on his fingers in a systematic fashion when given a textual number stimulus.

7. Say and "put out" the number of fingers (simultaneously) equal to a number presented (a) orally and textually, (b) orally only, and (c) textually only.

8. Say and "put out" the number of fingers to match an oral or textually presented number, and then count on the "put out" fingers from a second number (orally or visually given) so that the number reached when the child exhausts his "put out" fingers is equal to the sum of the two numbers.

Addition. The addition component consists of ten units with 15 sequences. These sequences are arranged to teach the child to perform the addition operation to multiple-column, multiple-number problems where carrying is necessary. The sequence begins with training the child to make an overt constructed response to "plus and equal" operation signs, using an imitative priming procedure. Next the child is taught to respond to horizontal addition problems (3+2=5). Transferring control to vertical format is accomplished by using a double presentation procedure where the previously trained horizontal format is used to prompt correct responses to vertical stimuli. The complexity of problems is increased in small steps, first where sums are small and require no carrying, then to larger sums with carrying. Through selective reinforcement, teachers eliminate the overt use of the finger-counting algorithm.

After completion of the addition sequences, the child is able to correctly and reliably:

1. Respond "Plus" when asked to identify the plus sign, put out fingers equal to the right number in horizontal addition, textual format, and then orally count with these fingers beginning with the number at the left to the sum.

2. Respond "Equals" when asked to identify the equal sign, complete horizontal addition of two numbers using the previously

trained finger-counting algorithm, and construct (write) a textual answer.

3. Respond to vertical, two-number, single-column addition problems (solve) using the finger-counting algorithm, and construct a textual answer.

4. Respond to vertical, two-number, single-column addition problems using the algorithm, but counting silently.

5. Respond to vertical, two-number, single-column addition problems without overt oral counting or overt use of the finger-counting algorithm.

6. Say the "addition facts" (sums equal to or less than 20), with a latency of less than five seconds, when presented with vertical, two-number, single-column addition flash cards.

7. Independently and rapidly solve two-number, single-column addition problems with the schedule thinned to one reinforcement per correct page.

8. Independently solve multiple-number, single-column addition problems where sums do not exceed 20.

9. Independently solve multiple-number, double-column addition problems not requiring carrying.

10. Independently solve multiple-number, multiple-column addition problems requiring carrying.

Subtraction. The subtraction component of the arithmetic program consists of eight units with 15 sequences. These sequences are arranged to teach the child to solve multiple-column, successive borrowing subtraction problems. The sequence begins by training the child to make an overt oral response to the minus sign. As mixed addition and subtraction are introduced, the overt precurrent attending response becomes functional. The child is trained on an overt finger-counting algorithm for subtraction which is subsequently used in the verbal borrowing chain (an overt precurrent response chain for borrowing). Zero is introduced for the first time in subtraction as the solution to problems where the minuend and subtrahend are equal, so that the response is functional (x-x is nothing!). At the top of the subtraction component, the child will be responding to zero in the minuend and borrowing from successive columns. In the present program, the finger counting algorithm is faded to a covert level by requiring the child to respond faster and faster, but the overt verbal borrowing is retained.

After completion of the eight units, the child is able, unit by unit, to correctly and reliably:

1. Respond "Take away" when asked to identify the minus sign, and solve two-number, single-column subtraction problems using an overt verbal chain and a finger-counting algorithm for subtraction.

2. Discriminate and solve mixed addition and single-column subtraction problems not requiring borrowing operations (subtraction finger counting is acceptable).

3. Solve multiple-column subtraction problems, going from right to left columns, not requiring a borrowing operation (finger counting is acceptable).

4. (a) Answer "Yes" or "No" to whether or not the subtrahend is larger than the minuend, (b) subtract two, three, or four-column, non-borrowing problems from right to left, (c) solve subtraction problems where the minuend is a two-digit number (10-19) and the subtrahend and remainder are one-digit numbers, and (d) write the number that precedes a given number.

5. Solve two-column subtraction problems utilizing the verbal borrowing chain.

6. Solve multiple-column subtraction problems utilizing the verbal borrowing chain.

7. Solve multiple-column subtraction problems utilizing the verbal borrowing chain where successive borrowing is necessary.

8. Solve multiple-column subtraction problems utilizing the verbal borrowing chain where one must borrow from zero (0).

Monitoring and Evaluating Progress

The teacher-child interaction is the foundation for program evaluation and redesign. Because of her close contact with the child, the teacher can effectively arrange antecedent stimuli, sequences, and consequences. Daily monitoring of the child's progress makes it possible for the teacher to modify sequences according to the demands of each child. While a teacher is programming for a child, the child's behavior prompts and reinforces the teacher's efforts, resulting in a teacher-child interaction that is self-correcting. The pupil thereby determines his own program and the teacher, by arranging contingencies of reinforcement, serves as a representative of the society. The teacher's success is a function of her sensitivity to the child's behavior (teacher's monitoring) and creativity (teacher's arranging of functional contingencies).

Data are collected to (1) serve as the basis for objective criteria for moving the child forward in the program; (2) indicate program deficiencies for individual children so that remedial units can be constructed; and (3) serve as a basis for revision of the arithmetic program.

The child's tutor collects data on the stimuli to which the child responds, including prompts, the correctness of the response, and the frequency of reinforcement in all units where the child does not make a constructed or discriminated textual response. If the response is textual, the data are taken directly off his worksheet for analysis. The teacher assigns the next section of the program when the child reliably performs above a 90% accuracy criterion. If it appears that occasional errors are primarily a function of inadequate attending behavior, the teacher allows the child to progress to the next unit, and makes a point of strengthening attending behaviors during the session. The 90% accuracy criterion for mastery has proven valid, for only one child required further remedial work after he had satisfied the criterion.

Example of Two Units in the Arithmetic Program

The units (8 & 9) described below are designed to help the child change from overt finger-counting algorithm to covert responding. The purpose of these sequences is to increase the child's speed in doing arithmetic problems and to make the use of addition more functional for him. (He is more likely to be reinforced by members in his community if he neither counts aloud nor uses his fingers to get the answer.) The procedures are remarkably simple in that the teacher takes the role of the verbal community and reinforces "being quiet" and "not using fingers." For the covert verbal counting program, the teacher merely tells the child to count silently and reinforces the child's correct solution responses. That is to say, the teacher uses an instructional prime to eliminate a response and then reinforces the second part of the chain (solution). Fading overt finger counting is done by the use of a "finger-counting box." This is merely a box under which the child places his hand when he is counting, thereby removing the visual stimulus. Again the child is reinforced for correct answers and for keeping his hand out of view. After some practice, the box is removed and the overt use of fingers is given a negative instructional prime ("Do these problems, but don't use your fingers."). The child is reinforced for correct solutions when he has not used overt finger counting.

A. Objective of Unit 8: To transfer overt verbal counting to covert responding.

B. Pretest (informal):

Teacher: "Do these, only count quietly."

Child: Does problems.

Teacher: Reinforces child if he counts quietly; if not, she presents the programmed sequence.

C. Evaluation: If the child counts quietly, and finds solutions, he is advanced to the next unit.

D. Materials: Addition problems in vertical format.

Teacher: "Do these problems, counting quietly."

Child: Counts quietly ⟶ reinforcement
Not quietly ⟶ correctional procedure

Teacher: Reinforces correct answers and quiet counting.

A. Objective of Unit 9: To fade the overt use of finger counting. It is identical to unit 8 except that the child is provided a "counting box" to cover his hand. Verbal counting should be covert.

B. No Pretest.

C. Sequence: Now that the child is using finger counting quietly, this program makes the finger counting covert by removing visual cues and increasing the speed requirements.

D. Materials: Finger-counting box.

Teacher: Places box over child's hand and monitors the child's behavior.

Child: Reinforced for counting silently, keeping hand under box, giving correct solutions, and increasing the speed of his responses.

Data on the Arithmetic Program

Standardized tests were administered to the children by the teachers on admission to the class and at the end of the academic year. For arithmetic, three achievement tests were used: The Caldwell Preschool Inventory (1967), The Wide Range Achievement Test (WRAT) (1965), and the tests from the Arithmetic Program. The Caldwell is a brief standardized assessment procedure designed for children in the three-to-six age range. The numerical section of the test consists of nineteen oral questions. The child is asked: Questions concerning the number of body parts (eyes, noses, hands, toes); the number of wheels on vehicles (car, bicycle, tricycle, wheelbarrow, and row boat); to count to five; the number of corners on a sheet of paper;

to identify (more, less, or equal) arrangements of checkers; and to identify in a line of checkers the first, second, middle, next-to-last, and last ones. Maximum score is nineteen. The second test, the Wide Range Achievement Test, covers dot counting, number recognition, oral more-or-less problems, and simple oral story problems using addition and subtraction. Scores are given in grade equivalents with N referring to nursery school, Pk. to pre-kindergarten, Kg. to kindergarten; numbers designate the elementary grade levels, beginning with one (1.0). The third test from the Arithmetic Program is derived from the general and unit program pretests and posttests. The pretest score refers to the child's repertory at entrance and the posttest score represents the final unit mastered at the end of the academic year.

Table 8-1 shows the scores on the three tests for the children

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Insert Table 8-1 about here

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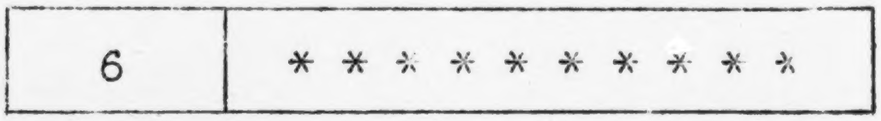
for the 1970-71 classes. The table also shows for each child, age on admission, Peabody Picture Vocabulary Test age and quotient (Dunn, 1959), and number of months each child attended class. It can be seen that all the children who were in school for four or more months, with the exception of one, C.B., made substantial gains. C.B. had persistent difficulty in discriminating between written numbers. This deficiency restricted her to oral arithmetic until late in the school year. The greatest gain in arithmetic, 1.8 grades, was attained by K.D.

Two children, who had difficulty with the unit involving dots, numbers, and sets, were studied in detail because of their implications for improving the arithmetic program.

The three types of arithmetic tasks in question - dots, numbers, and sets - occur in the program after number discrimination, recognition, and verbal counting from 1 to 20, and before the introduction of addition. In the first type of task, A below, the child first looks

A



at the number in the box at the left, then counts and circles the number of symbols (6 stars) that are equal to the numeral. In the second type of task, B below, the child counts the group of symbols in the box and

Table 8-1

Children's Arithmetic Scores at the Beginning and End of the Academic Year, 1970-71

Child	Age on Admis.	PPVT Score on Admission Age	PPVT Score on Admission Quotient	Months in Class	CPI Score Pre	CPI Score Post	WRAT Grade Placement Pre	WRAT Grade Placement Post	Arithmetic Program Units Pre	Arithmetic Program Units Post	Gain
B.B.	5-10	4-7	80	1	12	--	*Kg.5	--	1	2	1
C.B.	5-6	5-5	89	6	8	10	--	Kg.2	1	2	1
G.B.	5-11	5-4	91	8	16	17	1.2	2.1	1	21	20
N.B.	5-5	4-2	88	4	8	13	1.0	Kg.6	4	18	20
P.C.	8-10	7-0	83	9	17	16	1.6	2.4	19	26+	7+
A.D.	7-3	7-10	108	9	18	18	Kg.6	Kg.6	1	11	10
K.D.	5-9	4-11	85	9	9	12	**PKg8	1.6	2	20	18
H.G.	6-9	5-8	85	7	11	15	--	1.4	1	8	7
W.J.	5-3	3-10	59	1	13	11	Kg.9	1.4	4	15	11
M.K.	7-1	3-10	59	1	13	11	Kg.9	1.4	4	15	11
M.E.M.	5-8	3-7	59	8	10	13	PKg6	Kg.9	1	17	16
M.L.M.	6-10	5-8	85	4	13	15	1.2	1.8	1	17	16
S.M.	5-8	4-11	85	3	--	7	Kg.2	Kg.6	1	3	2
K.S.	6-10	6-2	91	1	15	15	PKg8	PKg6	1	3	2
S.W.	8-11	7-5	86	9	9	12	Kg.2	1.0	4	11	7

**PKg. = Pre-Kindergarten
*Kg. = Kindergarten
-- = No test available

B

# # # # # # # #	7 8 4 9

circles the equivalent numeral to the right. The third type of task, C below, requires the child to count the group of symbols on the left

C

§ § § § § § §	§ § § § § § § § § §

and then count and circle an equal number of symbols on the right. Ten problems in each kind of task are usually included in a daily assignment.

The children work on these problems under two conditions: Intermittent Teacher Attention (ITA) and Continuous Teacher Attention (CTA). During ITA condition, the teacher moves around the classroom dispensing praise and marks to individual children for correct work. During the CTA condition, the tutor works with the child individually giving verbal praise and a mark each time he correctly completes a problem. Thus, intermittent reinforcement is given in ITA, and continuous reinforcement in CTA. In both situations, if the child answers a problem incorrectly, he is simply instructed to go on to the next problem.

In the tasks described above, each is viewed as a sequence of chained responses (i.e., "a sequence of responses in which one response produces conditions essential to the next") (Ferster & Skinner, 1957). For example, in the first task, counting and circling the number of symbols equal to a given number, the following responses (Rp's) occur:

R_{p1} - Identifies the numeral "6"
↓
R_{p2} - Points to the first *
↓
R_{p3} - Says "one"
↓
R_{p4} - Points to the second *
↓
R_{p5} - Says "two"
↓
•
•
•
↓
R_{p12} - Points to the sixth *

↓
R_{p13} - Says "six"
↓
R_{p14} - Circles six *'s

Although each of these responses (and similar ones in the other two tasks) can, and had been reinforced earlier, only the terminal response of "circling six stars" was reinforced during the ITA and CTA conditions.

Figure 8-1 shows the performance of the first child, S.W. Although

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Insert Figure 8-1 about here
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S.W.'s early performance with relatively easy, pre-addition problems was satisfactory in the ITA condition, it deteriorated as the level of difficulty increased. His average accuracy across the 18 ITA sessions was 63%, far below the 90% required to advance to the addition units. At the nineteenth session, a tutor was provided and the Continuous Teacher Attention condition was initiated. Average accuracy for S.W. across the nine CTA sessions was 60%, almost identical to the previous ITA condition.

Since consistent differential reinforcement of the three terminal arithmetic behaviors proved ineffective, the training sequence of reinforcing each component of each task was started whereupon accuracies for all nine of the resulting CTA sessions were above 90%.

A replication of these results was attempted by first disrupting S.W.'s performance and then by retraining him with the previous training sequence. In the first several conditions (R_1), the tutor gave S.W. the daily assignment, left the room and returned when S.W. completed it, to check his work and give verbal approval and a mark for each correct problem. Figure 8-1 (R_1) shows that S.W.'s performance did not decline to the original levels (average accuracy was 82%) and that the last two sessions met the 90% mastery criterion. Thus a second reversal condition (R_2) was initiated. The R_2 condition was identical to R_1 with the exception that the tutor did not check S.W.'s completed assignment and did not give verbal approval or marks. Figure 8-1 (R_2) shows that accuracy still remained high, but the rate of responding to the problems declined from 30 problems in 10-15 minutes to two problems. Since the R_2 did not accomplish the objective of disrupting the accuracy of S.W.'s performance, a third reversal condition (R_3) was put into effect. In R_3, the tutor worked with S.W. and gave him verbal approval and a mark for every incorrect answer. Figure 8-1 (R_3) shows that performance declined to a low of 7% under these conditions.

Next the original training sequence was readministered and the frequency of errors declined at approximately the same rate as it had

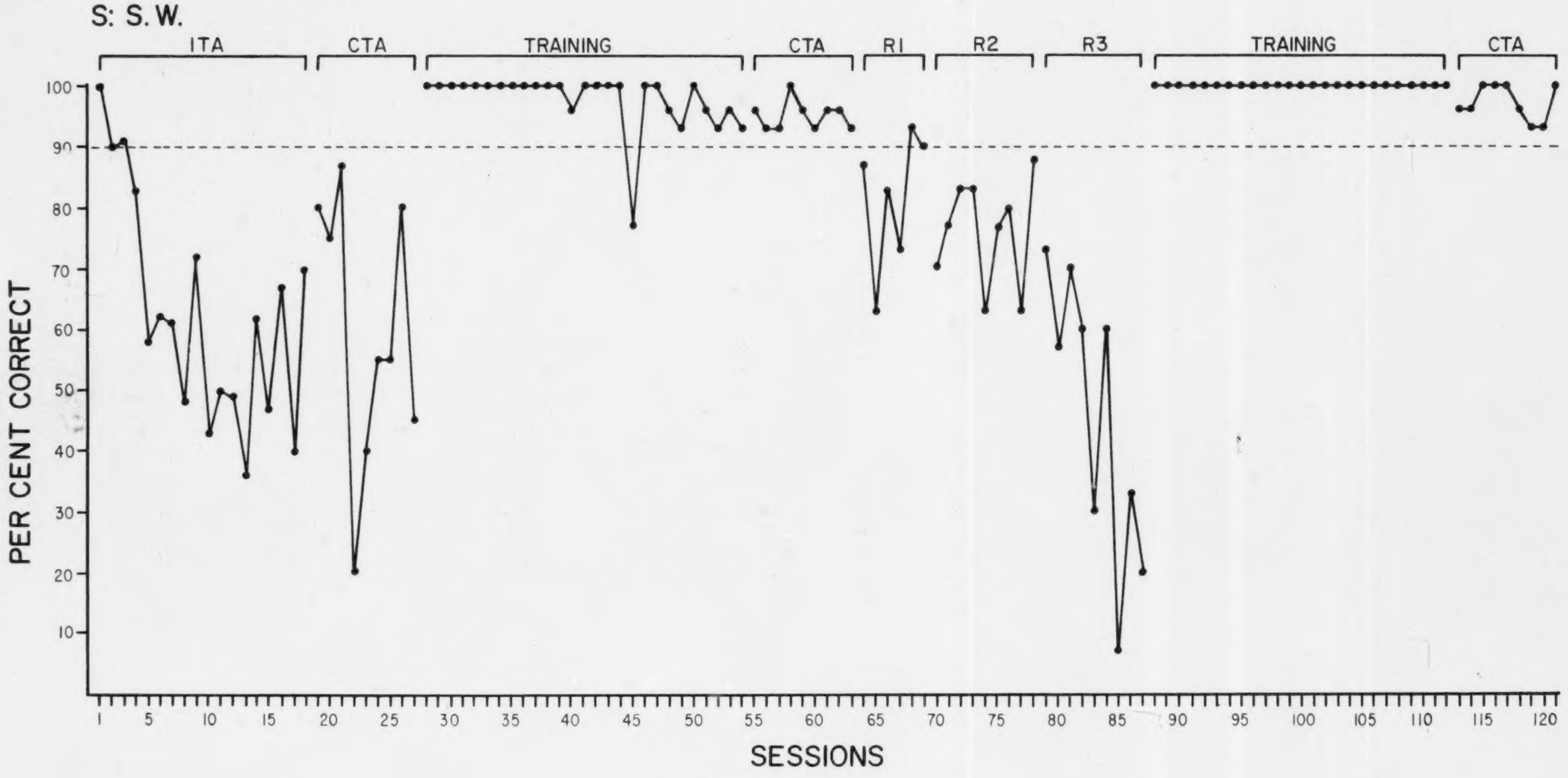
S: S.W.
ITA
CTA
TRAINING
CTA
R1
R2
R3
TRAINING
CTA
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
SESSIONS
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Figure 8-1

in the original training. The nine final CTA sessions in Figure 8-1 show that S.W.'s work remained at the 90% mastery level.

Figure 8-2 shows the performance of the second child (A.D.) under all the conditions described above. A.D.'s progress was remarkably similar to that of S.W. The average accuracy was 53% under the ITA condition, and 50% with a tutor, under the CTA condition. Figure 8-2 (CTA) shows that training resulted in a highly accurate and stable performance. Like S.W.'s, A.D.'s performance was not completely disrupted by the first reversal (R_1) involving reinforcement at the completion of the daily assignment. Figure 8-2 shows that A.D.'s accuracy also increased toward the end of the R_1 condition. However, the second reversal (R_2), involving no reinforcement for correct problems, was effective; the child continued to work at a high rate (i.e., 30 problems in 10-15 minutes) until accuracy fell to 27%.

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Insert Figure 8-2 about here

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The second training sequence did not result in A.D.'s complete mastery of the arithmetic tasks during the following CTA condition, due, in part, to the impending close of the school year, and an attempt to finish the training phase before school was over. Accuracy for the last CTA sequence ranged from 80% to 97%. Following the third CTA condition, training was begun once again but unfortunately could not be completed by the end of the school year.

To summarize, it can be stated that the behaviors dealt with in this study are complex. They include discriminated responses, constructed responses, fine-grain motor responses with a pencil, verbal responses, and the synchronization of verbal and motor responses. Known behavior principles of chaining and reinforcement, originally derived from infrahuman research, were utilized in an applied setting to remediate academic problem behaviors which are considered to be prerequisite for many arithmetic skills. Differential reinforcement of the terminal products of the three chains did not strengthen the chain appreciably even when the complete chain occurred at a respectable rate during the Intermittent Teacher Attention condition. Intermittent reinforcement (ITA) versus continuous reinforcement (CTA) of the terminal response did not affect the strength of the chain. However, a well established chain was efficiently maintained under the CTA conditions.

The results of research of this kind can be used to develop remedial procedures. The core training procedure described here was shortened while the study was in progress, and the condensed version used successfully to deal with similar problems with two other children.

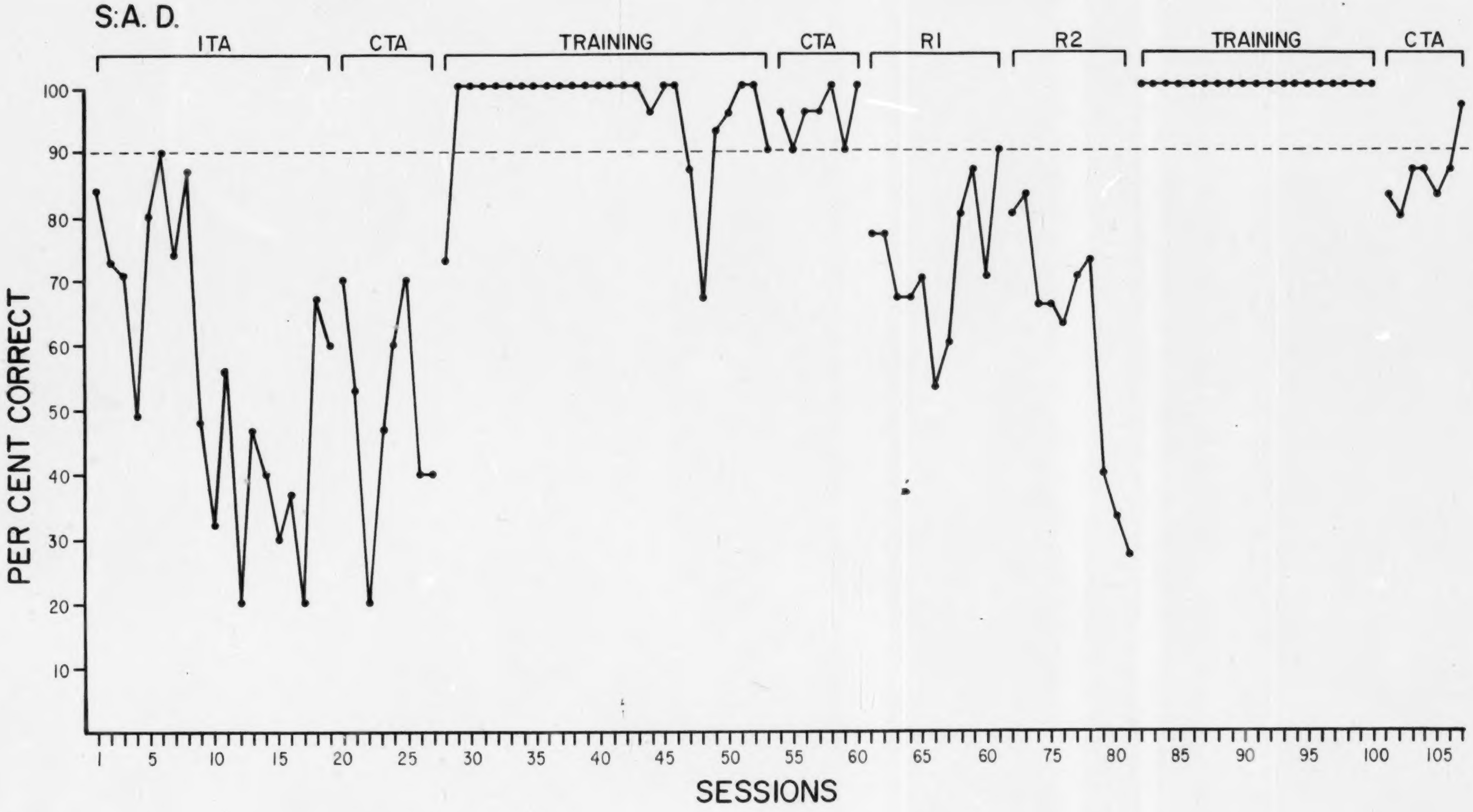
S:A. D.
ITA
CTA
TRAINING
CTA
R1
R2
TRAINING
CTA
PER CENT CORRECT
100
90
80
70
60
50
40
30
20
10
1
5
10
15
20
25
30
35
40
45
50
55
60
65
60
75
80
85
90
95
100
105
SESSIONS

Figure 8-2

9. The Writing, Spelling, and Language Programs

The Writing Program

Introduction

Writing is the production of written symbols (textual stimuli) that serve as discriminative stimuli for reading and arithmetic behaviors. In a finer analysis, there are two kinds of writing, distinguishable by the form of the stimuli that control the production of the symbol. First, there is the behavior of writing from a model, which, in a way, is a constructed version of the match-to-sample task. Secondly, there is writing in response to dictation, or self-produced cues. Such behavior normally is referred to as spelling and composition.

Since writing is a form of verbal behavior, it can be compared with the other two "R's" of verbal behavior: reading and arithmetic. Analyses of these two subjects have revealed that the teaching of reading and arithmetic involves, primarily, the establishment of appropriate stimulus control (e.g., the response "5" is under the control of "2+3;" the verbalization "fish" is under the control of the letters, f-i-s-h). The contingency depends on the cue-relevancy of the response. Teaching writing, on the other hand, is principally a process of response differentiation, or the shaping of a response. As the phrase, shaping of a response, indicates, the emphasis in writing is on the shape or topography (form) of the response, rather than on the antecedent controlling stimuli. Reinforcement is contingent upon the form of the response, not upon the conditions under which the response is made.

The three areas of verbal behavior differ in their standards for a correct response. The criteria for reading and arithmetic are set by the society for which the teacher is an agent. The society defines "12" as the criterion response to "8+4;" the teacher cannot reinforce "11" because it "approximates" 12. The answer must be exact. Similarly, the correct verbal response to s-t-a-r is "star"; the correct response cannot be shaped up by reinforcing "car" as an approximation to the desired vocalization. The established and acceptable solutions to arithmetic and reading problems are then, we see, unique. Such is not the case with writing. Although the criteria for correct responses in writing are, in general, established by the verbal community, the teacher has great latitude in what she considers an acceptable response. Responses in writing can be partially correct; in reading and arithmetic, they are either right or wrong (i.e., P, written so, is correctly formed, but the slant is incorrect; E is correctly constructed but the elements are disproportionate. Both letters may very well be accepted as meeting the criterion, since there is greater tolerance for variance in writing. Most often, a legible response approximating the model is considered "correct." As we know, there are more acceptable writing styles than are correct ways to read a passage, or correct answers to a problem in subtraction. A unique feature of writing, in contrast to reading and arithmetic, is that it can be shaped more simply than just working up from easy to more difficult words or problems. The response E, for example, can be shaped in the sense of reinforcing successively closer approximations to the desired topography (Ɛ—, Ɛ—, E).

The process of response chaining is important in all three forms of verbal behavior. In reading, it involves the stringing together of words; in arithmetic, the learning of arithmetic "facts;" and in writing, the smooth execution of complex letters and sequences.

Writing is similar to reading in that it is strongly maintained by contingencies in the natural environment. When you can write, you can label your own possessions, sign out library books, communicate by letter, write checks, and even qualify for credit cards. Reading is equally well maintained by natural contingencies, although arithmetic (due to its present level of automation) is most often reinforced by artificial and arbitrary contingencies (e.g., solving textbook problems). Perhaps this is why arithmetic is considered by some children as the "least favorite" subject in elementary school.

In constructing a program to teach writing, the following points should be considered: (1) Writing is the shaping of a motor skill to the point where the product of the response approximates a specified model or topography. The terminal responses (letters) can be broken down into components or elements. Production of these elements should be mastered before the elements are combined into a more complex letter form. Letters containing a common element should be taught together. For example, the child already knows how to make a circle because he has circled answers in pretests in the reading program, etc. Since a small circle is the common element in a number of letters, the child can readily be taught to make an a, b, c, d, g, p, and other rounded letters. (2) Writing should be maintained by natural contingencies. Writing can be made functional for the child by teaching him to write his own name, words, stories, etc. as soon as possible, so that the contingencies of the social environment can take over maintenance of the behavior.

Description of the Writing Program

The writing program was revised during the summer of 1969 and was extended in the summer of 1970 to include cursive writing. The need for the revision became apparent when, after completing the then existing program, which relied heavily on tracing, several children were able to execute the final tracing step, but were unable to meet the criterion of legibility on primary paper. The revised program teaches the child to make, on primary paper, exact copies of letters and words from models furnished him. Emphasis is put on having the letters and numerals "sit" on the lines of the primary paper as they do in the model. A child is reinforced specifically for a proper "fit" within the lines. The objective of the program is to teach the child to write manuscript and cursive letters and words in response to printed, typewritten, or oral cues.

Writing is a formal part of the class curriculum. Each child has a folder in which is written his daily assignment, planned particularly for him on the basis of his previous day's performance.

The writing sequence involves manipulation of several dimensions. A child can progress independently in each of these sequences: (1) holding the pencil, (2) making finer discriminated and differentiated responses, (3) working with smaller and more distant models, and (4) mastering increasingly more complex letters.

1. Holding the pencil. The terminal behavior of this segment of the program is for the child to hold a pencil correctly. First, the teacher determines whether the child is right or left-handed. This is done by asking him to point, to pick up and hand objects to the teacher, and to show how high he can reach on the wall. If the child is clearly right or left-handed, he is taught to hold a pencil with his preferred hand. A child who uses both hands in the tasks is observed over an extended time to determine which hand is preferred and he is taught to hold a pencil in that hand. If no preference is apparent, the parents are consulted and a decision is made regarding his training.

The primary pencil is marked with red, blue, green, and white pens to help the child learn how to hold it. Corresponding marks are put on the child's fingers with crayons or magic markers, to show where each of the three "holding" fingers should be placed. A mark is also made where the pencil should touch the "v" between the thumb and forefinger. If necessary, a mark may also be made on the "v".

The steps in instruction are as follows: (1) The child's hand is marked and the pencil is marked (see Figure 9-1).

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Insert Figure 9-1 about here

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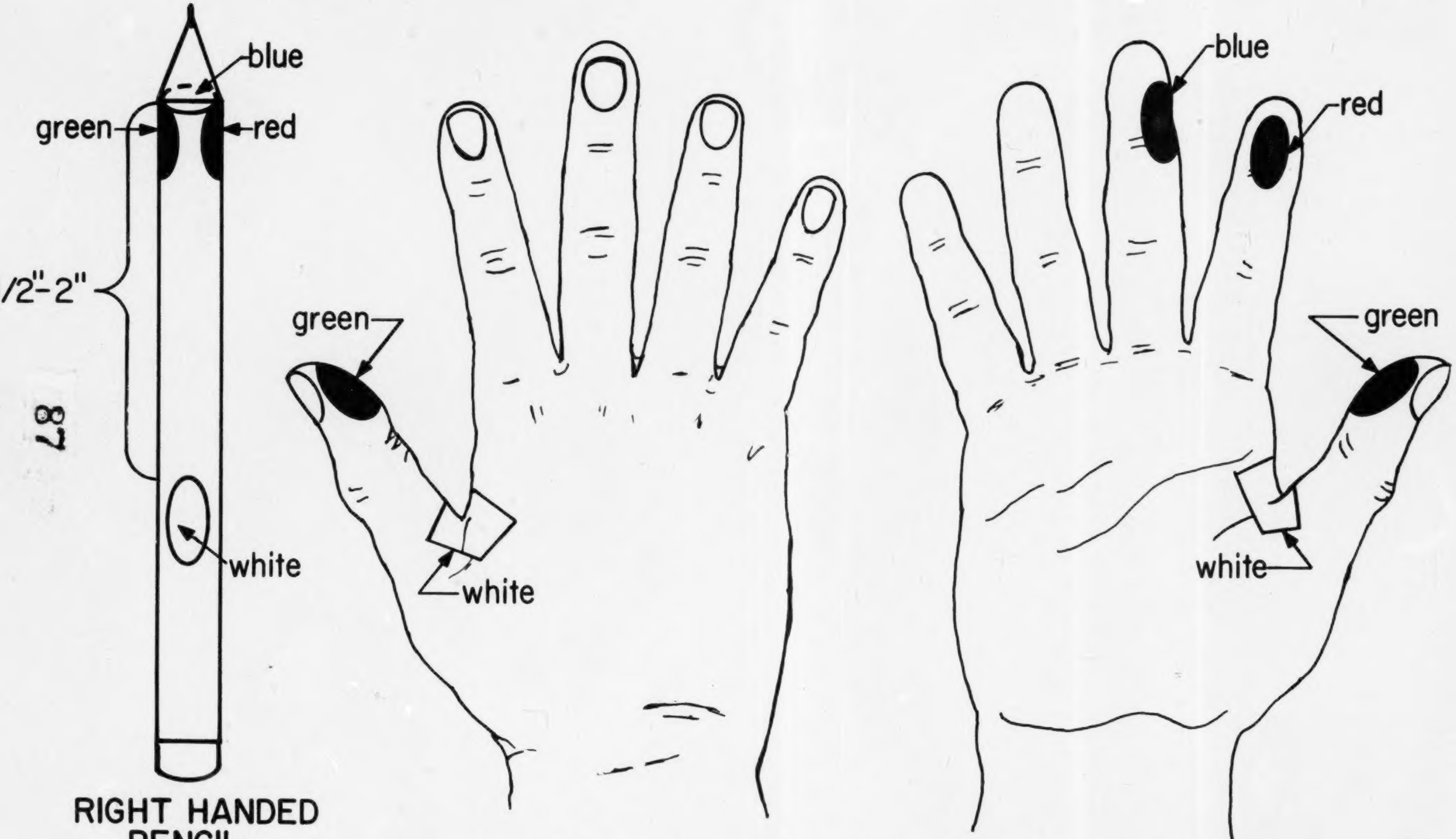
(2) The child matches dots on his fingers to dots on the pencil. The teacher holds the pencil and says, "Show me which finger goes here." Errors are corrected by taking the finger and touching it to the pencil at the properly marked point. (3) The child rests his hands on the desk. The pencil rests on the desk. The teacher picks up the pencil and touches the white mark on the pencil to the white mark on the hand, puts the pencil down, and says, "You do it - pick up the pencil." (4) The child continues to use the marked primary pencil. After a time, the colored marks can be faded.


blue
green
red
11/2"-2"
white
green
white
blue
red
green
white

RIGHT HANDED PENCIL

BACK OF RIGHT HAND

PALM OF RIGHT HAND

Figure 9-1

2. Making finer discriminated and differentiated responses. The type of paper used in the writing sequence is important. First, the lines on the paper indicate where to write. Second, the width of the spaces between lines determines how much control is required for successful reproduction of the models.

The child begins the writing program using paper with wide, easily discriminable, colored lines which requires only gross coordination and progresses to the point where he can successfully use paper with narrower, uniform lines which requires finer manual control. There are five kinds of paper: (1) Paper No. 1 contains only three writing lines on a page, an arrangement that makes it apparent to the child just where he is to write. The top, middle, and bottom guidelines are of different colors to emphasize where letters and numerals are to touch. (2) Paper No. 2 contains five writing lines on a page, requiring some discrimination on the pupil's part. Spaces are the same width as on No. 1 paper, but the colored guidelines are somewhat faded out. (3) Paper No. 3 is similar to No. 2 in width of line and number of lines per page. The one difference is that the top and bottom guidelines are now the same color; the midline is a second color. (4) Paper No. 4 is regular primary paper: five lines per page, width of space the same as Nos. 1-3. The three guidelines are more faint and all are a single color. (5) Paper No. 5 is advanced primary paper. There are seven writing lines per page with the width of the space decreased proportionally. All three guidelines are one color.

When the teacher observed that the child is performing well at one level (i.e., most of the productions remain within the lines), she advances the child to the next level.

3. Working with smaller and more distant models. There are two types of models for copying letters. The first are permanent models that are included in the child's daily folder as his writing assignment. These models have been constructed on No. 1 paper and are mounted in plastic so that they can be used repeatedly. There is such a model for every number and letter. The second type is a model constructed by the teacher at the beginning of each line of work.

Initially, the model is the same size as the expected response and is on the line the child uses to make his copy. As he moves through the program, a transition is made to smaller, typed models on a separate paper.

4. Mastering increasingly more complex letters. The sequence of presentation of letters is determined in an order of increasing complexity. All letters are analyzed into simple components or elements and are presented for learning in groupings based on the presence of a common element. For example, when the two first components (a horizontal and a vertical stick) have been mastered, the letters l, t, i, T, I, L, E, F, and H are presented. One element is learned, along with all

its compounds before another element is introduced. The order in which the elements and compounds are presented is given below.

Elements	Compounds
— |	+ i T I L E F H 4
\ \	N
/ /	x X 7 Z z v V y Y M A W w K k
O o	O c a d 8 Q C c G e 9 q p 6
J ʃ	j f g
ɔ	P R B 3 D 2 5
U u	U u
n	n m h r
S s	S s

Once the child has mastered the capital and lower case letters and the digits in the programmed order, he goes on to construct from models words from the reading program. With the introduction of words, there are instructions for proper spacing of letters within the word. After working on single words, the program advances to writing of phrases and, finally, of sentences.

Pretest. Before beginning the writing program, each child is given a pretest which requires him to reconstruct all capital and lower case letters from given models. Since the models are not presented on lines nor the reconstructions made on lined paper, there is no way to assess the child's ability to coordinate between the lines. The pretest does, however, provide knowledge of the child's entering repertory, of his handling of a pencil, and of his general manual coordination.

Teaching procedure. When introducing a letter or component, the teacher indicates and names the permanent model, demonstrates how the letter is formed, and instructs the child to follow the steps in the same order. Verbal instructions are given along with the model. The child is reminded to stay between the upper and lower guidelines: "I want you to copy this letter making sure that you stay between the blue lines." Hand-guiding is also used. If the child is having difficulty producing the letter, and verbal and hand-guiding aids are not functional, the teacher makes a dotted figure for the child to trace several times.

While the main emphasis is on obtaining a proper "fit" between the lines, other criteria are applied to responses in the writing program: Is the movement smooth and continuous? Are there angles where there should be? Is there proper spacing between letters and words? Is the production consistent?

Contingency management. Reinforcement in the form of praise and marks is given for successive approximations to the desired letter, but once the child has mastered a level of achievement, he is not reinforced for a lower level of work. The criterion for reinforcement is having the letter touch the lines in the proper place.

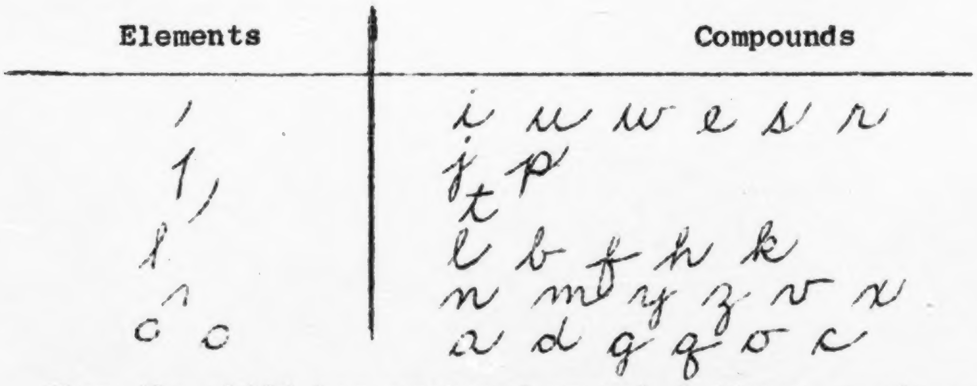
Errors are corrected immediately. The child is stopped at the point in the letter where he begins to go wrong and is corrected there, not after he has completed the letter incorrectly. If the child is not attaining the required skill level, the teacher again demonstrates how the letter is made, or breaks up the response into smaller steps and builds the desired response. For example, "4" can be broken into its three parts.

Transition from Manuscript to Cursive Writing

When the child has completed the manuscript program, cursive writing is introduced. The analysis of letters into elements and their presentation in the order of complexity is the same as those in the manuscript program. The format of the materials is a sheet of primary-ruled paper with the model (permanent and teacher-constructed) at the left-hand side of the line.

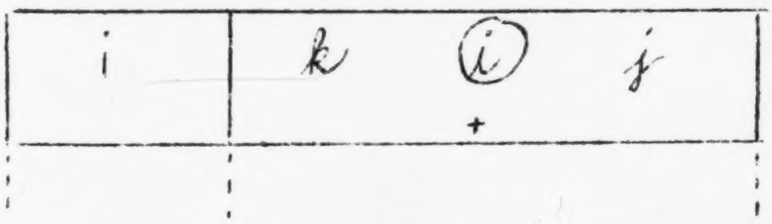
The child is given the page, shown how to put it at the proper angle on his desk, and told to look at the sample. He is asked the name of the letter and is then shown how the letter is made. If he does a reasonably good job in making the letter, he is reinforced. If he has difficulty in making the letter, various aids are used. For example, the teacher may guide the child's hand as he makes the figure, and then gradually withdraw this prompt. Or she may outline the letter with dots and he can trace it.

To date, only the program for lower case cursive writing has been prepared. A summary of the basic elements and their corresponding compounds is given below:



When the child has mastered enough letters, words are introduced in the same way in which the letters were introduced. Model words are constructed from the letters the child already knows. At this stage in the program, the child is given a list of the printed and cursive equivalents of the letters, to use as prompts.

After the child has learned the first five letters (i, j, u, w, t), the cursive identification program is begun and continues simultaneously with the cursive writing program. This is a matching task designed to teach the child the cursive equivalents of printed letters. Each frame is divided with the printed letter on the left and three cursive letters on the right, the correct one and two distractors. The task can be done independently by the child, using a simple teaching machine. The child inserts the page in the machine and pushes it up to the first frame. He looks at the printed letter, finds the cursive letter that matches it, and circles this letter. He then pushes the page up to see whether his choice was right. A plus sign appears under the correct answer as shown below:



Teaching cursive writing, using a programmed arrangement of elements and compounds, has proven fairly successful, although further refinements and testing will make it even more effective. Figure 9-2 presents

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Insert Figure 9-2 about here

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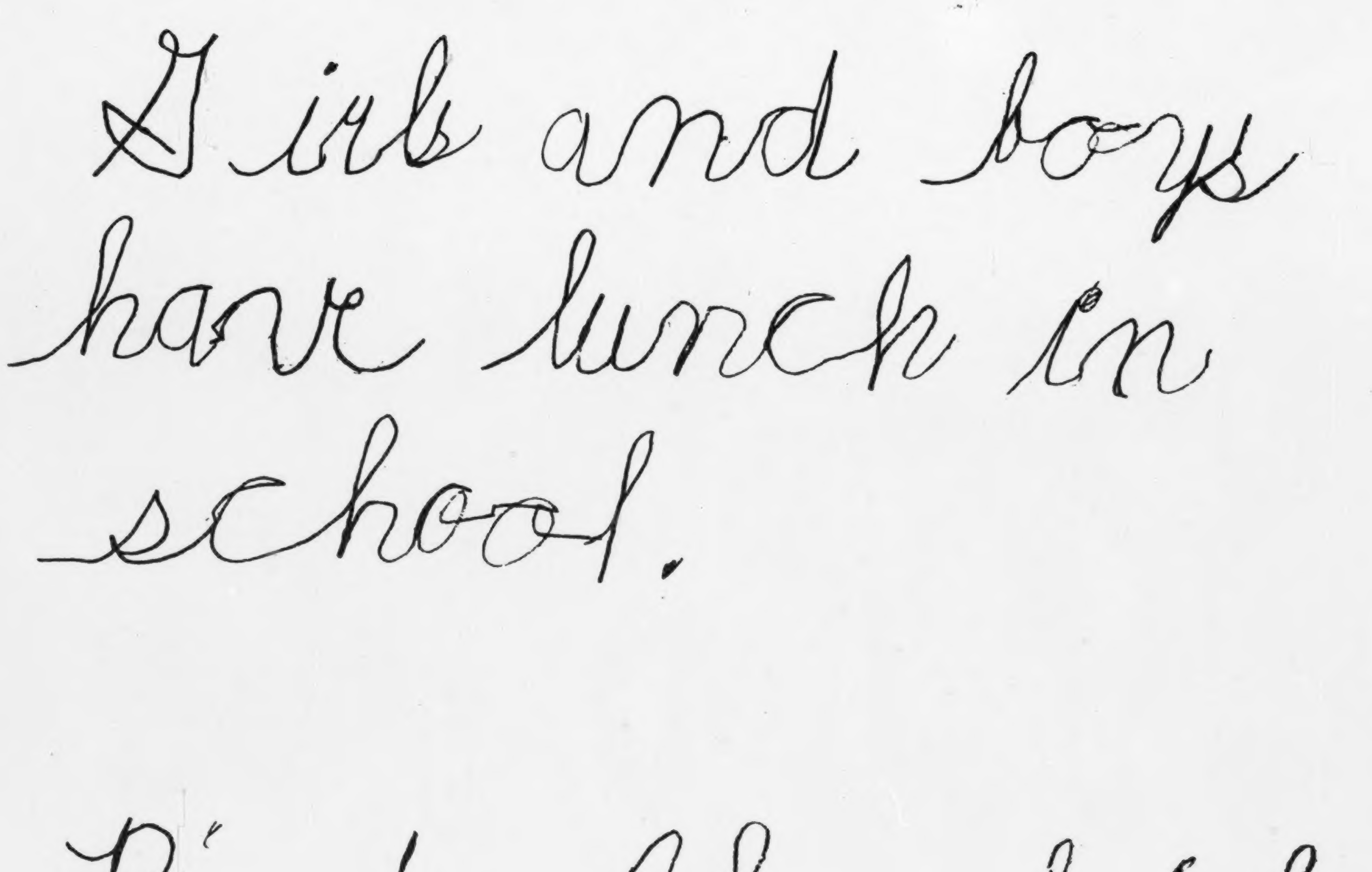
samples of the terminal behavior of K.D. on the cursive writing program. K.D. began the academic year on the most elementary level of the manuscript program, completed that level and progressed through the entire program for cursive letters.

Making writing functional. An attempt was made during the 1970-71 school year to extend the writing program beyond the mechanics of letter production. This program was designed in response to the problems of one particular youngster. The child, A.D., was making little or no progress on the writing program: praise and marks did not result in either on-task behavior in writing or in successively closer approximations to model figures. The teacher was advised to try a different attack. A.D. was asked to dictate stories to his teacher in response to magazine pictures. When he finished his story, he used the teacher's written text to write the story himself. Words that met the standards of touching the lines, proper spacking, etc. were cut out of the primary paper on which he had written and pasted in story fashion below the picture. Words and phrases were rewritten until they met the legibility standards for inclusion in the story page.

Figure 9-3 presents samples of A.D.'s writing immediately prior to



Girls and boys
have lunch in
school.

Birds fly high

Figure 9-2

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Insert Figure 9-3 about here

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the introduction of the story-writing procedure, and Figure 9-4 is a

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Insert Figure 9-4 about here

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sample of his work four days later. The change is dramatic. Apparently this exercise was highly reinforcing for A.D. because (1) the form of his writing showed rapid improvement, (2) problems of off-task behavior were greatly reduced, (3) he progressed from writing separate letters meeting program criterion to writing complete phrases, and (4) his stories became progressively more elaborate and soon his writing included letters to relatives and friends.

Monitoring Writing Behavior

A record is kept of each child's progress through the program, including the date on which each letter was introduced, the level of paper being used, and the attainment of satisfactory achievement on the various letters and numbers. A summary of the data for all children using the Writing Program during the 1970-71 academic year is presented in Table 9-1.

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Insert Table 9-1 about here

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The Spelling Program

Introduction

Spelling may be analyzed as the production of oral letters in a sequence (constructed verbal responding) or the production of written letters in a given sequence (constructed textual responding). In oral spelling, the child must know the names of the letters; in written spelling, he must know how to write the letters. With only a few exceptions (e.g., telegraphy, flag signals), spelling behavior occurs as a response that precedes writing. Even the question, "How do you spell 'necessary'?" leads to a verbal response that in turn leads to a written response by the questioner. Thus the terminal functional spelling response is the production of a written, not an auditory stimulus. Although knowing the names of the letters is not a prerequisite for written spelling behavior - a child may write the word, cat; read the word, cat; and match the word with a picture of a cat, without being able to identify the letters, c-a-t - this knowledge is an aid to written spelling in at least two respects. (1) In a classroom, oral spelling usually has more immediate consequences from

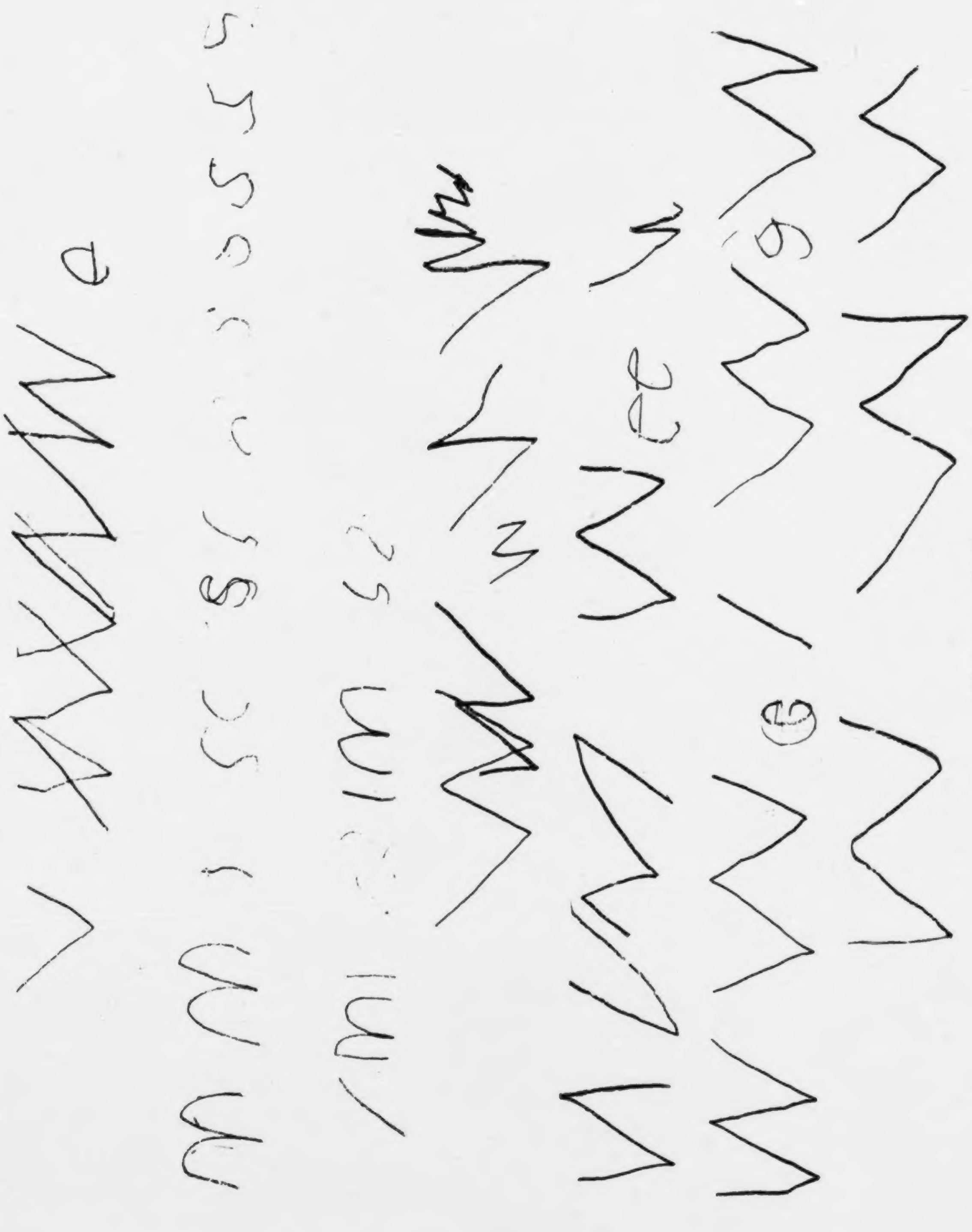
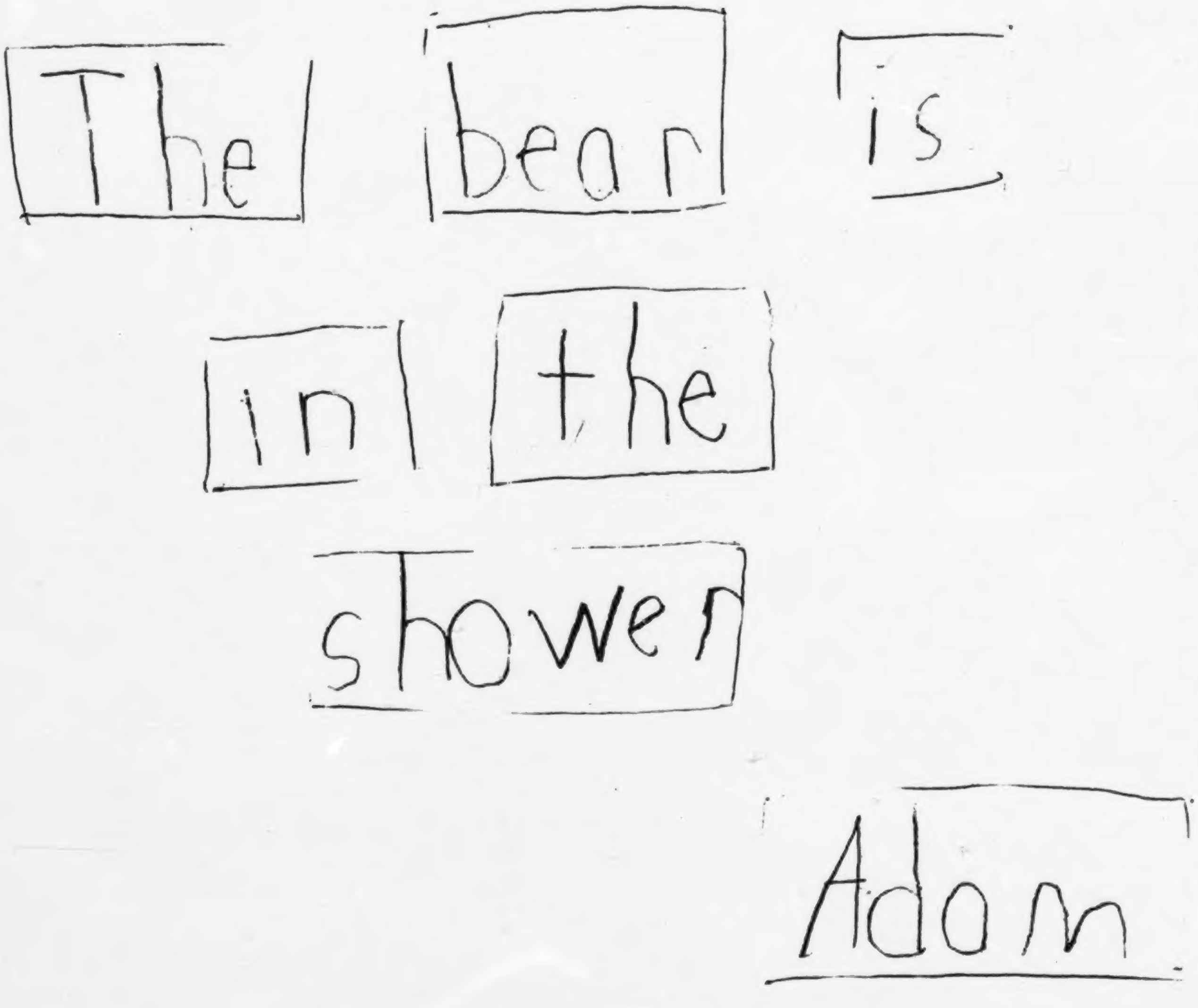


Figure 9-3



The bear is
in the
shower

Adom

Figure 9-4

Table 9-1

Summary Data for Children Using the Writing Program for the 1970-71 Academic Year

Child	Age on Admis.	Entering Behavior		Days on Program 35 min/day	Terminal Behavior		Comments
		Paper No.	Letter Sequence		Paper No.	Letter Sequence	
C.B.	5-6	1	1	91	4	56	Incomplete Alphabet
G.B.	5-11	1	1	100	5	-	Complete ms. program
H.B.	5-5	1	1	26	5	68	Complete ms. program
P.C.	8-10	4	68	60	5	-	All cursive; sentences
A.D.*	7-3	1	Pencil Prog.	111	5	**	
K.D.*	5-9	1	1	153	5	-	All cursive; ms. program
H.G.	6-9	1	1	92	4	68	Complete ms. program
W.J.	5-3	1	1	44	4	68	Complete ms. program
M.K.	7-1	3	1	38	4	68	Complete ms. program
M.E.M.	5-8	1	1	132	4	67	Phrases
M.L.M.	6-10	1	1	59	5	67	Phrases
S.M.	5-8	1	1	49	4	55	Incomplete Alphabet
K.S.	6-10	1	1	30	4	41	Incomplete Alphabet
S.W.	8-1	3	67	110	5	-	All cursive; sentences

*Writing samples from these students are presented in Figures 9-2, 9-3, and 9-4.

**Modifications in the normal order of presentation were made for A.D. He was writing words using the letters he had mastered before he had completed the entire sequence of letters.

the teacher than written spelling. (2) Systematic self-prompting is more probable when the child knows the names of the letters.

Using the analysis of reading behavior as a guide, the acquisition of spelling should proceed in a sequence that requires the child (1) to discriminate the target word from other words, a skill generally acquired during the reading program, (2) to copy the target word from a model, first achieved in the writing program and strengthened further in the spelling program, (3) to read orally the target word, as acquired in the reading program, (4) to write the target word from dictation, and (5) to name orally the letters of the target word in sequence when the word is presented orally.

Description of the Spelling Program

The terminal behavior taught by the spelling program is a constructed written (textual) response to an auditory stimulus (i.e., writing words from dictation). The same vocabulary list and word sequence are used for both spelling and reading. There are thus 26 units in the spelling program. Before he is placed in the spelling program, the child (1) must have completed the first 10 words in the reading program, and (2) must have progressed in the writing program to the level of copying words from a typewritten model.

The spelling program requires the following materials: 3" x 5" study cards with typewritten models of words from the reading program; Language Master cards with auditory models of words from the reading program (see Figures 7-3 and 7-4); a homemade teaching aid, called a study board, with one area for exposing or covering the typewritten model and another area for storing models of words already studied; a Language Master tape recorder/player; and pencil and paper.

Each child has a spelling folder in which he keeps paper and his study board. Daily, the teacher places the 3" x 5" assignment cards and the Language Master cards in the pocket of the study board. At the beginning of the program, the child is given only 3 words at a time, then 5, then 10, depending on his speed and accuracy.

Self-study procedure. The child is taught how to learn new spelling words. At the beginning of the spelling period, he takes out his spelling folder and removes the materials. He places the study cards with the models in a pile on the first area of the study board. He attends to the first word, covers it, and immediately writes it. When he has written it, he then exposes the model again and checks his spelling. If the word is correct, he removes the study card to the second area of the study board and goes on to the next word. If the word is incorrect, he goes through the sequence once again. The teacher intermittently provides verbal approval and marks for correct work, and help when necessary.

Evaluation. When all the words have been written correctly, the child takes the Language Master cards and a clean sheet of paper to the table with the Language Master tape recorder/player. He runs the cards through the machine one at a time, writing the words as he hears them. When he has completed the assigned words, he returns to his seat with his materials and raises his hand to indicate that he has completed the lesson. The teacher comes to his desk and checks the spelling. She reinforces the correct words and asks him to rewrite all incorrect words.

The program is varied for individual children. Children who display high accuracy on the study part of the program (writing from written models) are allowed to take the spelling test first and study only the words which they missed. The test is repeated after the child has written the incorrect words.

The child's correct and incorrect responses are recorded each day in a spelling flow chart. The child is given new words when the words written from the auditory models are all correct. All words are systematically reviewed to check retention.

Spelling and writing. The behaviors required by the spelling program give the teacher an opportunity to extend and refine writing skills. Spelling can almost be viewed as the terminal writing behavior. The child's written responses in spelling must meet all of the criteria used in the writing program. This means that topography of the written response is reinforced as well as the accuracy of the letter sequence. If the topography of the written spelling response is unsatisfactory, the child must copy the word again from a written model.

The strengthening of independent spelling behavior. The use of the study board and the Language Master teaching aids are designed to encourage independent study. Prerequisites for entry into the spelling program (i.e., progress in the Reading and Writing Programs) are also designed with this goal in mind. Thus the child just entering the program has already learned how to manipulate all of the materials and has many of the behaviors necessary for success in spelling. The teacher serves a maintenance function (i.e., she intermittently dispenses reinforcement for on-task behavior and approves tests) and seldom engages in modifying the program in class. Spelling is often a child's first independent experience with an academic task and the consequences of his behavior are thus important for independent performance in the other academic subjects. The spelling program is viewed as a crucial step, along with reading, in reintegrating the child into a regular classroom.

Data on the spelling program. Table 9-2 shows grade levels for

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Insert Table 9-2 about here

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Table 9-2

Spelling Scores on the Wide Range Achievement Test and
the Spelling Program Tests for Children
in the 1970-71 Classes

		WRAT Spelling Grade			Spelling Program No. of Words Covered
Child	Months in Program	Pre	Post	Gain	
N.B.	1.5	1.1	2.0	+.9	50
G.B.	5.5	1.2	1.6	+.4	61
C.B.	0	-	Pk.3	-	0
P.C.	8.5	1.8	2.0	+.2	260
A.D.	0	*Pk.5	**Kg.5	+1.0	0
K.D.	5.5	Pk.7	1.0	+1.3	100
H.G.	0	-	1.0	-	0
W.J.	0	-	Kg.9	-	0
M.K.	0	1.3	1.4	+.1	0
M.M.	0	Pk.7	Kg.8	+1.1	0
M.L.M.	0	Kg.8	1.4	+.5	0
S.M.	0	Kg.9	Kg.8	-.1	0
K.S.	0	Kg.9	Kg.8	-.1	0
S.W.	9	1.3	2.0	+.7	130

*Pk = Pre-Kindergarten
**Kg = Kindergarten
- = No test available

the spelling test of the Wide Range Achievement Test and progress in the spelling program for all children enrolled in the Laboratory classes in 1970-71. The average gains in grade level on the WRAT ranged from .2 to 1.3 with an average of .7 grade for children who were placed in the spelling program versus .4 grade for children who were not.

The Language Program

Introduction

The Language Program is designed to strengthen and maintain a number of academic and non-academic responses that the community expects 6 and 7-year-old children to have. Thus responses were selected for inclusion in the language program which would increase the probability that the children would be reinforced by their social group. Since community reinforcers are most often verbal, a setting of several youngsters and a teacher in verbal interaction is the most suitable learning environment.

Description of the Language Program

One of the primary objectives of the Language Program is to make academic responses acquired in formal programs functional for obtaining reinforcement in more natural settings. For example, although the arithmetic program teaches number recognition, counting, addition, and subtraction, these responses alone are functional only in academic settings. Money values, time-telling, using rulers, and common fractions are the responses most likely to maintain number manipulation outside the classroom. These types of responses are taught in the Language Program. In addition, non-academic responses such as name and address, rhyming, seasonal characteristics, and communication skills, are also accomplished in the language period.

Precurrent repertories for language. Typically, in kindergarten and primary language classes, the teacher discusses some topic and then asks questions, selecting a child to answer. Answers are either oral or require manipulation of materials (e.g., setting the hands on a clock). Specific precurrent behaviors, which are functional for increasing the likelihood of being reinforced, are required: (1) The child must attend to the discussion, materials, and previous teacher-child interactions. The answers to oral questions are found in prompted form in these situations. (2) The child must attend to the specific question and to the relevant materials in order to respond appropriately to the question. (3) The child must be seated at his desk. (4) The child must raise his hand in order to be called upon to answer. Children entering the Laboratory school invariably lack many of these behaviors. For this reason, during the first few weeks of school, and to a lesser degree thereafter, a child is praised and is called upon whenever he engages in the appropriate precurrent behaviors described above. Precurrent responses reinforced during the language period are maintained throughout the day by intermittent praise.

Strengthening language behaviors. Precurrent responses and correct answers are strengthened by making teacher praise and marks contingent upon these behaviors. As responses are strengthened, praise and marks are used less frequently. In this way, weak responses are strengthened and maintained with minimal chance of satiation. Typically, marks are preceded by praise. Occasionally, the teacher praises the child and a teaching assistant gives the marks.

Weakening incorrect and disruptive behaviors. Incorrect responses are dealt with by two basic procedures: (1) The child is corrected, asked the question again, and praised for the correct answer; and (2) the child is told his answer is incorrect. Another child is then called upon and is subsequently reinforced if he answers correctly. If neither child responds correctly, the teacher provides the correct response or obtains it from some child.

"Off-task" behaviors (out of seat, not attending, playing with materials, etc.) are systematically ignored. If a child's off-task behavior disrupts another child or is severely distructive, he is warned and on persistence, removed from the classroom.

Sequences and sequencing. The structure of the language period is flexible in that each of the two classes covers a different sequence at any one time. It is possible to switch a child from one class to another on the basis of the extent of his language repertory. Few sequences are designed to require mastery of other language sequences, unlike the reading sequences, for example.

Materials for the Language Program are inexpensive and easy to produce. A blackboard, flannel board, calendars and worksheets, pictures cut from magazines, toys, homemade paper clocks, and other such simple objects, account for most of the things used. Occasionally, generalization of concepts is accomplished using objects in the classroom (lights, tables, pictures, etc.). Only one formally programmed sequence is currently used. It is designed to teach the following common word concepts:

Prepositions	Verbs	Adjectives
on	talking	more - less
under	looking	straight - crooked
over	going	smooth - rough
in front of - behind	making	light - heavy
between		dry - wet
close to - away from		loud - soft

This common words sequence, administered by a tutor, utilizes concrete objects (i.e., blocks, sandpaper, small toys, water, etc.) about which the children are required to respond in complete sentences.

In general, the specific common words sequences are constructed so that on the first several items the child need only provide a simple verbal response. Later, he is required to give a complete verbal constructed response and a discriminated motor response.

The common words sequences are semi-structured in the sense that the tutor has the opportunity to select the objects used for each item, thus allowing for generalization. The procedures are specific to the questions asked and instructions given, the appropriate responses, and reinforcement and correction procedures. Sample questions and acceptable answers for terminal items are given below:

Question: "Is the car under the table?"

Answer: "Yes, the car is under the table."

Question: "Show me the rough one."

Answer: Child points to rough object.

Question: "Where is the smooth one?"

Answer: "The smooth one is behind the rough one."

The remainder of all instructions are informally programmed by the teachers and presented during the 25-minute group language period. Group discussions are used in the typical question - answer - reinforce format for the concepts listed below:

1. Seasons and seasonal characteristics
2. Days of the week
3. Months of the year
4. Use of the calendar
5. Colors
6. Right versus left
7. Name and address
8. Geometric shapes
9. Money values
10. Time-telling
11. Rhyming

12. Use of singular and plural nouns

13. Use of the ruler

14. Classification of objects (e.g., fruits, furniture)

15. Punctuation (e.g., period, question mark, quotation marks)

16. Oral-written word correspondance

17. Geographical location (cities, states, countries)

18. Fractions (1/2, 1/3, 1/4)

19. Use of pronouns

20. The alphabet

21. Letter recognition

22. Counting by 5's and 10's to 100

Sequencing of these topics is programmed to keep the language period stimulating. That is, in one period up to five topics can be discussed, with review and extension of several of these topics the following day. As the children master the information about a topic, it is removed from the pool.

Example of an informal sequence. The geometric-shapes sequence begins with the teacher drawing several shapes on the blackboard (circle, triangle, square, and rectangle) identifying each. She then names one shape and asks a child to come and point to the corresponding form. Later, both a discriminated (pointing) and constructed (naming) response are required. To help them to generalize, children are asked to look about the room and find and name objects of a specific form. In all cases, correct responses are followed with immediate praise, and occasionally with a mark. Errors are corrected, using both of the procedures previously mentioned.

Throughout all programmed sequences, the teacher reinforces approximations to more efficient communication skills. If a child misuses a part of speech (e.g., "Me go home."), he is corrected and asked to repeat what he wants to say, using the appropriate word. Longer and more complex sentences are modeled by the teacher and correct imitations by the child are reinforced.

Some Data on the Language Program

The Caldwell Preschool Inventory is used as a crude indicator of changes in language. The Inventory was administered at the beginning and the end of the academic year. Table 9-3 presents

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Insert Table 9-3 about here
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pre- and posttest scores for "Personal-social Responsiveness" (social concepts) and "Associative Vocabulary." The number of months the child attended the Laboratory school is also given. "Personal-social Responsiveness" includes questions about the child's personal world (name, address, parts of body, friends) and tests whether or not a child can carry out simple and complex verbal instructions. "Associative Vocabulary" assesses the child's comprehension of words, roles, and concepts.

Table 9-3

Scores on the Caldwell Preschool Inventory for the Children in the 1970-71 Program

Initials	Months in Program	Associative Vocab.* Pre	Associative Vocab.* Post	Social Concepts* Pre	Social Concepts* Post
B.B.	1	13	-	21	-
C.B.	6	7	8	15	20
G.B.	8	18	20	23	25
N.B.	4	15	12	19	19
P.C.	9	17	18	26	25
A.D.	9	20	20	24	25
K.D.	9	14	16	17	19
H.G.	7	10	13	16	17
W.J.	4	11	11	17	21
M.K.	1	9	12	15	19
M.E.M.	8	16	17	19	18
M.L.M.	4	15	18	24	25
S.M.	3	-	7	-	15
S.W.	9	21	21	20	20

*The maximum score possible is 26.

- = Not tested.

10. Behavioral Assessment: Techniques for the Teacher

Traditional assessment of children in special education is oriented toward making predictions of the child's performance in an average classroom and toward making diagnoses which consists mainly of identifying and classifying behavioral problems according to the presumed causes. This kind of information and prediction is of no service to the special education teacher because the child's performance in class is primarily dependent upon the way the teacher arranges conditions and reinforcement contingencies to expedite learning in the child. Psychometric tests do not even identify the contingencies currently maintaining the child's behavior, much less give an indication of how those contingencies should be altered. Nor is clinical diagnosis of much use to the teacher because (1) it encourages a tendency to explain the behavior by labeling the child, and (2) it contributes nothing toward planning an educational program for the child.

Assessment, to be functional, should be oriented toward the child's observable, current behaviors. A child's situation should be assessed for the purpose of obtaining information that will aid in planning, administering, and evaluating a curriculum particularly for him. Since she has these three responsibilities, the teacher should make the assessment. To assess the child and his situation adequately, the teacher in special education needs at least five kinds of information: (1) the child's current repertory of social skills in relation to the desired classroom behavior, (2) the child's current repertory of academic skills in relation to the specific academic programs in use, (3) the child's current repertory of academic skills in relation to subjects not formally programmed, (4) the child's behaviors which interfere with his school progress, and (5) the kinds of stimuli that function as reinforcers for the child.

The following discussion, which deals with specific techniques for assessing the child's behaviors and related contingencies, proceeds sequentially with assessment of initial status, of progress during the school year, and of status at the end of the school year.

Assessment of Initial Status

Assessment of Behavior Prior to Enrollment in the Special Class

The initial opportunity for assessment occurs in the child's classroom before he is withdrawn from school. If at all possible, the teacher should visit the classroom to observe first-hand the problem in the situation in which it is occurring. The information she gathers in the problem setting can often serve as a baseline against which the success of later instruction may be evaluated.

Before discussing specific assessment techniques, a brief review of the range of behavioral problems to be assessed is necessary. These have been grouped into three broad categories: behavioral excesses, behavior deficits, and inappropriate stimulus control (Bijou & Peterson, in press). Behavioral excesses, commonly called conduct problems, are those considered aggressive, extremely disruptive, destructive, or hyperactive. The latter usually means that the child is "off task," engaging in a high rate of inappropriate, non-academic behaviors or changing activities at a high rate.

Children with behavioral deficits include the withdrawn or isolate child, the child who does not talk, and the child who does not have the precurrent behaviors necessary for academic endeavors. Examples of the latter are inability to remain seated at a desk, inability to initiate speech sounds accurately, and inability to manipulate academic materials such as pencils, erasers, or book pages.

The third category of behavioral problems displayed in the classroom - inappropriate stimulus control - refers to behaviors that occur frequently but under inappropriate circumstances. Examples are crying in response to mild frustration and subtle aversive cues, strong dependent relationships with the teacher, and inept forms of play.

Although the teacher can record the occurrences of these behaviors in one of several ways (e.g., verbal accounts, rating scales, checklists), the most serviceable technique has been to record them in terms of frequency. Since this method has been discussed in detail elsewhere (Bijou, Peterson, & Ault, 1968; Bijou, Peterson, Harris, Allen & Johnston, 1969), only a brief example will be given here. The data presented in the upper part of Table 10-1 under "A" were collected on a six-year-old boy who was observed during a reading period in a first grade public school classroom. Each square in the table represents a continuous 10-second period. On-task behavior (working appropriately with the reading materials) and off-task behavior (anything other than on-task), are coded as N and F respectively. Each 10-second block was scored for the occurrence of either or both of these behaviors. Fifty-six per cent of the entries were N's and forty-four per cent were F's, with an overall reliability of 97%. Hence the child was on-task for only a little more than half of the total six-minute observation period and had a high rate of switching from reading to non-reading behavior (five times during the six-minute observation period).

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Insert Table 10-1 about here

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If more precise information about a child's off-task behavior is desired, the off-task category can be broken down into more specific behaviors. The data under the "B" part of Table 10-1 represent the behaviors of a different six-year-old boy during a reading period in a public school first-grade classroom. The child was off-task 67% of the observational period. Specific off-task behaviors which included

Table 10-1

Examples of Data on Two Children (A and B) Taken in a Public School Classroom

A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	N	N	N	N	N	F	F	F	F	F	F	F	F	F	F	F	N	N	N	N	F	F	N

25	26	27	28	29	30	31	32	33	34	35	36
N	F	N	N	F	N	F	N	N	N	N	N

B

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	N	N	N	N	N	N	F	N	F	N	N	F	N	N	N	N	N	F	F	F	F	N	N
												I							I	I			
							6		6			6						6	3	3	3		

25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
F	N	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
I																							
6		3	3	3	3	3	3	3	6	6	6	6	6	3	6	6	6	6	6	6	6	6	6

49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66						
F	F	F	F	F	F	F	F	F	F	F	F	F	F	N	N	N	N						
										I	I	I	I	I									
6	6	6	6	6	6	6	6	6	3	6	6	6	6										

physical aggression, destroying materials, disrupting other children's study, making fun of other children, and sitting quietly doing nothing were recorded in the third row of the data sheet. The only off-task behaviors observed in this sample were "disrupting other children's study" (3) and "sitting quietly" (6). The child disrupted other children 27% of the time when he was off-task, and sat quietly 73% of the time.

Information concerning the consequences of the child's behavior (e.g., peer attention, teacher attention, approval, and admonishment) can also be recorded. Thus, in the second row of the"B" section of the table, instances of the teacher talking to the child were entered as I. Although the child was on-task 33% of the time, the teacher paid attention to him primarily when he was off-task. It is quite possible that the differential attention by the teacher was partially responsible for this child's high rate of off-task behaviors.

It must be said that classroom observation has definite limits, especially when visitors are an unusual event. First, the presence of an observer may suppress or facilitate the behavior output of a child. Second, the presence of an observer may cause the teacher herself to radically alter her classroom behavior with resulting changes in the child's behavior. Third, the daily variability of some problem behaviors (e.g., physical aggression toward other children) makes it untenable to draw broad conclusions on the basis of small time-samples. The observer can minimize the effect of his presence by entering the classroom as unobtrusively as possible, by immediately breaking eye-contact with him, and by making observations at several different times.

The special education teacher can also obtain relevant information about the child from medical reports and from conferences with the school psychologist, the child's present teacher, and his parents. To be useful, all of this information must be evaluated in realistic terms. A conference with the child's parents is extremely important as a source of information about the child's family situation, and about his health. It also provides a clue as to the kind of support and cooperation the teacher may expect from the parents.

Entrance Assessment

When the child enrolls in the class, the teacher should personally administer the necessary standardized tests. These yield general information about the child's ability and how it compares with other children of the same chronological age, cultural background, and socioeconomic status. Standardized test results can also provide a gross basis against which later performance can be compared. To be maximally useful, such tests should directly measure behaviors in which the teacher is actually interested. Achievement tests and inventories usually meet this criterion. The Laboratory teachers administer the Wide Range Achievement Test (Jastak, Bijou, & Jastak, 1965) and the Caldwell Preschool

Inventory (Caldwell, 1967) within two weeks after a child's enrollment. The former measures achievement in reading, writing, spelling, and arithmetic, and the latter measures personal information (e.g., name, address, and body parts), ability to follow verbal directions (e.g., "Put the red car in the black box."), skills in numerical relations (e.g., "Point to the second object."), knowledge of physical attributes (e.g., colors and shapes), and listening comprehension (e.g., "What does a dentist do?").

Placement in academic programs. The teacher must also determine the child's entrance point into each of the academic programs in the curriculum. To avoid excessive frustration and boredom, the teacher should aim to place the child in *each* program at the highest level at which he can perform *successfully.* If he begins with a large amount of material that is too *elementary,* he may quickly lose interest in it, and the task of motivating him becomes correspondingly more difficult. On the other hand, starting the child at too low a level is a waste of instructional time. Again if the beginning material is too difficult and generates a high error rate, the child's academic materials may become aversive to him. Assessments with pretests based on the programs in reading, writing, spelling, arithmetic, and language serve to prevent these side effects. In view of the extended descriptions in Chapters 7 and 8 of the specific pretests used in this study, we shall here give only an example of the pretesting process and the consequent curriculum design at the time the child was assessed. The subject is N.B., a five-year-old boy, who was referred to the Laboratory because "He does not relate with adults, has emotional problems, and does not follow or join in group activities."

Reading. N.B. was successful on picture, letter, and word discrimination tasks, so it was not necessary to place him on the Attending Program. But he could not identify any of the words on the general reading pretest, and did not attempt to use phonics to sound them out. Nor could he correctly identify any of the 10 words in the first subset pretest of the Individualized Reading Program, although he could imitate all 10 words. Consequently, N.B. was placed in the first subset of the IRP.

Writing. N.B. held the pencil correctly and was able to copy from printed models, on unlined paper and without major errors, all of the letters of the alphabet. However, his writing had a marked tremor. He was assigned to work on No. 1 paper (wide lined) with training concentrated on eliminating the tremor.

Arithmetic. N.B. named all of the numbers from 1-10 and counted (sequentially) from one to the thirties. He was therefore given the pretests for the arithmetic program. He could imitate the numbers one through 20 presented orally in random sequence; he could count from any number (1-19) to any other number (2-20); he could identify (orally name and point to) any written number from one to 20; he could make equal sets and match sets and numerals. N.B. was started immediately on finger counting.

Language. N.B. could say the alphabet and name the primary colors. He named all of the upper-case letters (printed models) and all of the lower-case letters except d, b, l, i, g, and p. He was assigned to work on the six lower case letters in the group language period and in writing. N.B. was later pretested on other language units.

Spelling. Since N.B. did not identify any words in the reading program, he was not given spelling assignments until he had a sight vocabulary of at least 10 words.

Evaluation of pre-academic repertories. The techniques to be discussed now are directed toward obtaining information before, during, and after pretesting pre-academic behaviors, those behaviors that are the necessary prerequisite for academic behaviors. First, it is important to know how well the child will stay on task when he has the teacher's constant attention, or when he is being tutored. Since the teacher personally administers the standardized tests and program pretests, she has the advantage of seeing how the child functions under those conditions. Second, the teacher should assess the child's untutored work habits by observing him in the program pretests that do not require the teacher's presence (e.g., coloring with crayons, copying letters from a model, or simple picture or letter matching tasks in which the child draws a line connecting two identical stimuli). Such observations enable the teacher to determine whether the child requires tutored learning situations in the context of the regular academic programs.

An example of the importance of assessing tutored versus untutored work habits is shown in Figure 10-1. Each successive 15-second period during an observation session was scored if the child, R.B., was on task for more than half of the interval. It can readily be seen that R.B. was consistently on task when tutored, but was generally off-task during other academic periods when teacher attention was only intermittent. The information obtained indicates that R.B. requires tutoring in order to make progress in the academic programs and to learn to work alone. After the child establishes serviceable study behavior in a one-to-one situation assigned, the teacher gradually decreases her attention and physical presence and, at the same time, maintains R.B.'s on-task behavior.

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Insert Figure 10-1 about here

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The third class of pre-academic behaviors that require assessment includes the child's ability to participate as a member of a group. The main interest in group situations is the assessment of social behaviors (i.e., interactions with teacher and peers); however, there is some overlap with behaviors displayed in untutored situations since both involve independent work habits. Observations in a group situation are an

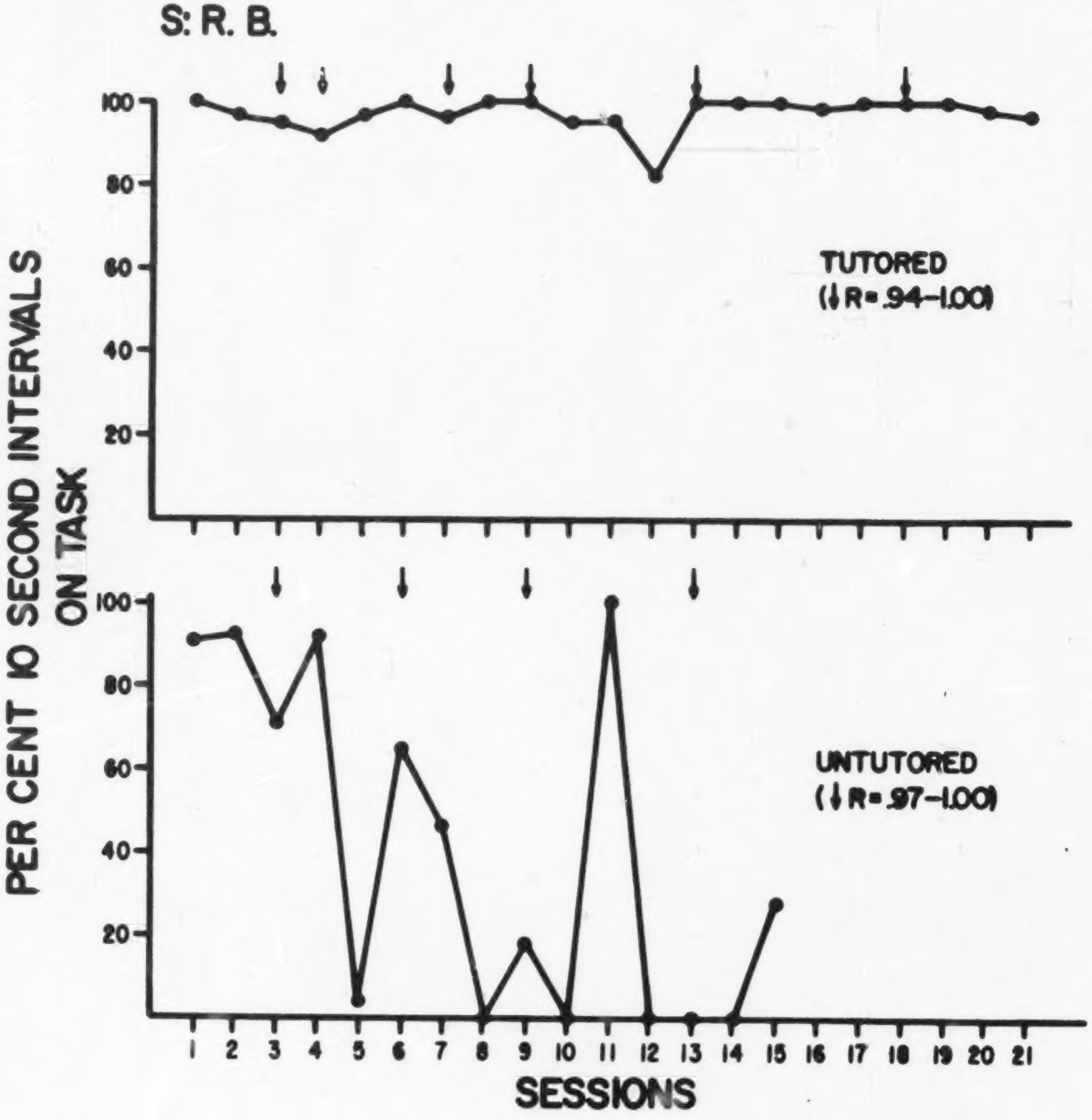
S: R. B.
PER CENT 10 SECOND INTERVALS ON TASK
100
80
60
40
20
TUTORED
(↓R = .94–1.00)
UNTUTORED
(↓R = .97–1.00)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
SESSIONS

Figure 10-1

aid in making early decisions about the need for informal programs for peer interactions, participation in academic groups (e.g., Does the child "volunteer" or does he have to be "called upon?") and adequacy of verbal behavior.

Evaluation of the child's sensitivity to behavioral consequences. Simply allowing a child to react to academic materials does not automatically strengthen his behavior in relation to them. The consequences of the child's behavior are of primary importance. If academic behaviors are not strengthened by the consequences of academic materials, the materials are not reinforcing. Because of the history of most handicapped children, the special education teacher must often look for other consequences, other reinforcers, that will support the acquisition and maintenance of academic behaviors. These include teacher attention, activities, non-exchangeable marks, and exchangeable marks.

The assessment of the reinforcing value of the teacher's attention can be accomplished quickly in the classroom setting. If her attention is not reinforcing to the child, he will probably go off task in all tutored situations including the administration of tests. The teacher may be able to keep the child on task by the use of aversive control but this is at best a temporary expedient which is often costly in terms of future progress. If the teacher is at all uncertain as to the reinforcing value of attention, she can quickly and precisely evaluate it by making her attention contingent upon some simple low-frequency behavior such as hand-raising. If attention is a reinforcer for a child, his hand-raising behavior will increase; it will decrease when the teacher reserves her attention for any behavior other than hand-raising. Certain activities such as recess, play-time, or art may also function as reinforcers when they are exclusively contingent upon some behavior. The teacher should evaluate these activities as possible reinforcers for a child, especially if attention is a weak reinforcer for him.

Non-exchangeable variations on marks, such as gummed stars, rubber stamps, seals, and numerical and letter grades with no "trade-in" value often function as weak reinforcers for academic learning. The reinforcing value of these tokens is probably related directly to the strength of contingent teacher attention and verbal approval. If the teacher's verbal behavior is not reinforcing to the child, it is unlikely that non-exchangeable marks will be very reinforcing for him. If, on the other hand, teacher approval is a reinforcer, these traditional symbols of approval may be used to increase the range of reinforcers, and thereby help to minimize decreases in performances due to satiation.

When the teacher's attention is not reinforcing, one of the most effective motivation techniques is a contrived reinforcement system in which marks are exchangeable for the privilege of participating in certain activities, or for small toys, candies, etc. These are known as "backup" reinforcers. An exchangeable mark system has several advantages over the direct use of "backup" reinforcers: (1) the relative ease of dispensing large or small numbers of marks, (2) the immediacy with which marks can be given after a response, and (3) the lack of satiation effects. Here again, the teacher must constantly assess the effects of the mark system on the child's behavior. In all instances, whether in the academic situations previously described or in dealing with problem behaviors, if the marks are reinforcers, behaviors which precede them will be strengthened.

Monitoring Behavioral Change

The wide range of individual differences among children in a special education class demands flexibility in the curriculum. As the classroom schedules change, as instructional materials are modified, as informal programs are instituted, as contingencies are altered, the teacher must be alert in assessing their effect on each child's behavior. There is no doubt that the major criterion for any changes should be the child's behavior. Since the child's behavior tells the teacher when to change the environment, and since the changes must, in turn, be evaluated on the basis of his subsequent behavior, assessment should be continuous.

Monitoring Techniques

Five types of monitoring techniques are utilized in the Laboratory classes. The first of these is the inevitable subjective impressions of the teacher. A subjective report on a child is vital because it often furnishes the beginning point or source of hypotheses for more objective monitoring. For example, if the teacher reports to her supervisor that a child appears to be off task more frequently than usual, steps are taken to collect more objective information on his behavior. If the teacher reports that the child is not making satisfactory progress in one of the academic programs, there follows a close evaluation of the child's behavior in relation to the program, the teacher's behavior in relation to the child, or the program itself.

The second technique utilizes the actual products of the child's behavior (his work output), and is generally confined to the academic programs. Completed writing assignments, sheets of arithmetic problems, written spelling pages, and tape recordings, when the responses are verbal, are all scrutinized and scored and the latter are entered on the child's progress chart.

The third technique is used primarily in tutoring. The tutor, or an observer, collects information concerning all correct and incorrect responses and the contingencies (i.e., the social and mark reinforcers) in force. This detailed information can be used to evaluate the child's progress, the behavior of the tutor, and the specific difficulties in the academic program.

The fourth monitoring technique, the use of frequent pre- and posttests based on actual instructional materials, is the method used to evaluate the child's progress and the overall efficiency of the academic programs. If the academic pre- and posttests are constructed so that they accurately measure the behaviors that the programs presumably teach, then these tests are the best criteria for judging the effectiveness of the programs. Evaluating an academic program on the basis of standardized achievement test scores does not produce useful information unless the program has been designed to teach the specific behaviors measured by instruments based on population norms.

The fifth and final monitoring technique has been referred to previously in this chapter in the section on the assessment of initial status. This technique can take many forms, ranging from the simple frequency of occurrence of some behavior (i.e., response event), cumulated in units as large as a day or week, to the automated recording of response and stimulus events along a continuous-time baseline. Frequency-of-occurrence data are most useful when the behavior to be observed is of very low frequency (e.g., one instance per hour). The only apparatus required is a mechanical hand-counter or a tally sheet. The reliability of observations is, however, often difficult to assess. More dependable and practical is the procedure in which data collected by an observer (teacher or assistant) who records instances of stimulus and response events on a sheet marked with successive time-units (Bijou, Peterson, Harris, Allen, & Johnston, 1969). If the stimulus and response events are defined in observable terms, and so specifically that two or more observers will agree as to the actual occurrence of an event, this method can be profitably used to assess the behavior of individual children in relation to the academic materials, the teacher, and other children.

Monitoring the frequency of occurrence of behaviors across successive time-units has two practical uses: (1) It is an excellent teacher-training device. Observation of behavior is the first component, the keystone of a teacher's wide repertory of skills. (2) Objective information on the strength of a certain behavior enables the teacher to spot even small changes in the strength of that behavior. Progressive desirable change in a child's behavior is not only a reinforcer for the teacher, it is also a cue that some formal or informal program is working successfully. A regressive change (or lack of change) is always an indication that some aspect of the learning environment must be modified. Without an objective frequency-of-occurrence measure, the teacher may be especially prone to erroneous conclusions about the changes in a child's behavior.

Applications

Monitoring changes in interfering behaviors. Most decreases in interfering behaviors occur as the result of strengthening appropriate behaviors which are incompatible with interfering behaviors. Obviously, a teacher must be a sharp observer. She must be alert to small increases in the strength (i.e., frequency of occurrence) of appropriate behaviors as well as to changes in the form of behaviors that more and more closely approximate a desired behavior. The reason for this alertness requirement is elementary; the teacher cannot reinforce behavioral changes that she does not observe.

Some decrease in the strength of interfering emotional behavior may occur as the child adapts to the classroom. Occasionally this decrease is so considerable that the child begins to display knowledge and academic skills not previously attributed to him in the initial assessment. For example, R.B., a child in the Laboratory school, initially behaved in many ways best described as fearful. He tended to remain in unoccupied rooms or close to walls, crossed open spaces very quickly, and often hid his face in his hands when approached by an adult or another child. These behaviors made it difficult for the teacher to administer the academic pretests and her impression, from the lack of responses, was that R.B. possessed only minimal academic skills. Two months later, after the interfering behaviors had decreased or disappeared, she again presented him with the general pretest for the reading program. Excerpts from the teacher's report follow:

> "Of the 40 words on the first page, R.B. read 22 quite clearly. Others were read so that the initial sounds were correct, but he didn't pronounce the last syllables or sound. On the second page of the test, R.B. read 4 out of 13 phrases perfectly. I was not able to tell whether R.B. could understand what he read or not; he did not answer questions about the words he read orally."

Clearly this child did have some academic skills, skills which would not have been discovered that soon had the teacher not reassessed the child's repertory. Several weeks later, R.B. also demonstrated his reading comprehension by following simple written instructions.

Monitoring changes in reinforcing functions. It has already been stressed that if the teacher wishes to strengthen academic behavior, she must first find a class of stimuli that are reinforcing to the child. Academic materials, teacher attention, and marks can be made reinforcing if they consistently serve as cues for the occurrence of events that are already reinforcing (i.e., toys, candy, etc.). Thus stimulus events may change in function from neutral or aversive to reinforcing. The teacher should continue to evaluate the contingent properties of stimuli so that she can make maximum use of reinforcers and avoid the erroneous use of neutral and aversive stimuli. A case in point is again provided by one of the children, S.W., enrolled in the Laboratory class, who, in the early weeks of attendance, appeared not to be sensitive to either teacher attention or exchangeable-mark reinforcement. In order to get some idea as to what might be reinforcing, the teacher visited his home and saw the toys he used in play. Some of these were brought back to the Laboratory class and were placed in a special reinforcement area, set aside just for him. Whenever S.W. completed a spelling assignment (including the corrections of errors) within the allotted time, he was permitted to play in his play area. The area was apparently serving as a reinforcer for S.W.'s spelling. However, as Figure 10-2 shows, the child failed spelling units more

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Insert Figure 10-2 about here

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frequently when access to the area was made contingent upon rapid, accurate spelling performance. Had she not been monitoring S.W.'s posttest performance over several days, the teacher would have been unaware of the need for modifying her procedure.

In order to continue to further strengthen behavior and to promote independent academic behaviors in the child, the teacher should systematically decrease the frequency of reinforcement during the school year. These changes in schedules of reinforcement should also be evaluated in behavioral terms. For example, if the frequency of reinforcement is decreased very rapidly, the accuracy of a child's performance may remain high but the rate of response to the academic materials may gradually decline. Gradual changes in behavior, those occurring over a number of days, may not be immediately apparent to a teacher without objective measures.

Monitoring changes in academic learning. If a child's normally good performance in academic work suddenly deteriorates, or if some new academic behavior is not acquired as readily as similar behaviors had been in the past, the fault may lie in the academic materials. Since sheer repetition is an inefficient technique of acquiring new behaviors, the academic materials should be modified so that the child makes steady progress. The effects of the modified materials on the child's behavior should, of course, be assessed. Information concerning correct and incorrect responses and their relation to reinforcers is of particular interest here. An example of a case of satisfactory progress, then a decrement in performance, followed by satisfactory process again consequent to the construction and application of a special remedial unit, is represented by K.D.'s performance on the Laboratory's reading program. After some initial difficulties with discriminated responses to different groups of letters, K.D. was successfully placed in the reading program (see Chapter 7, The Reading Program, for a detailed description of the techniques employed). In the graph at the top of Figure 10-3, the "A" portion of the overall-per cent-correct curve

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Insert Figure 10-3 about here

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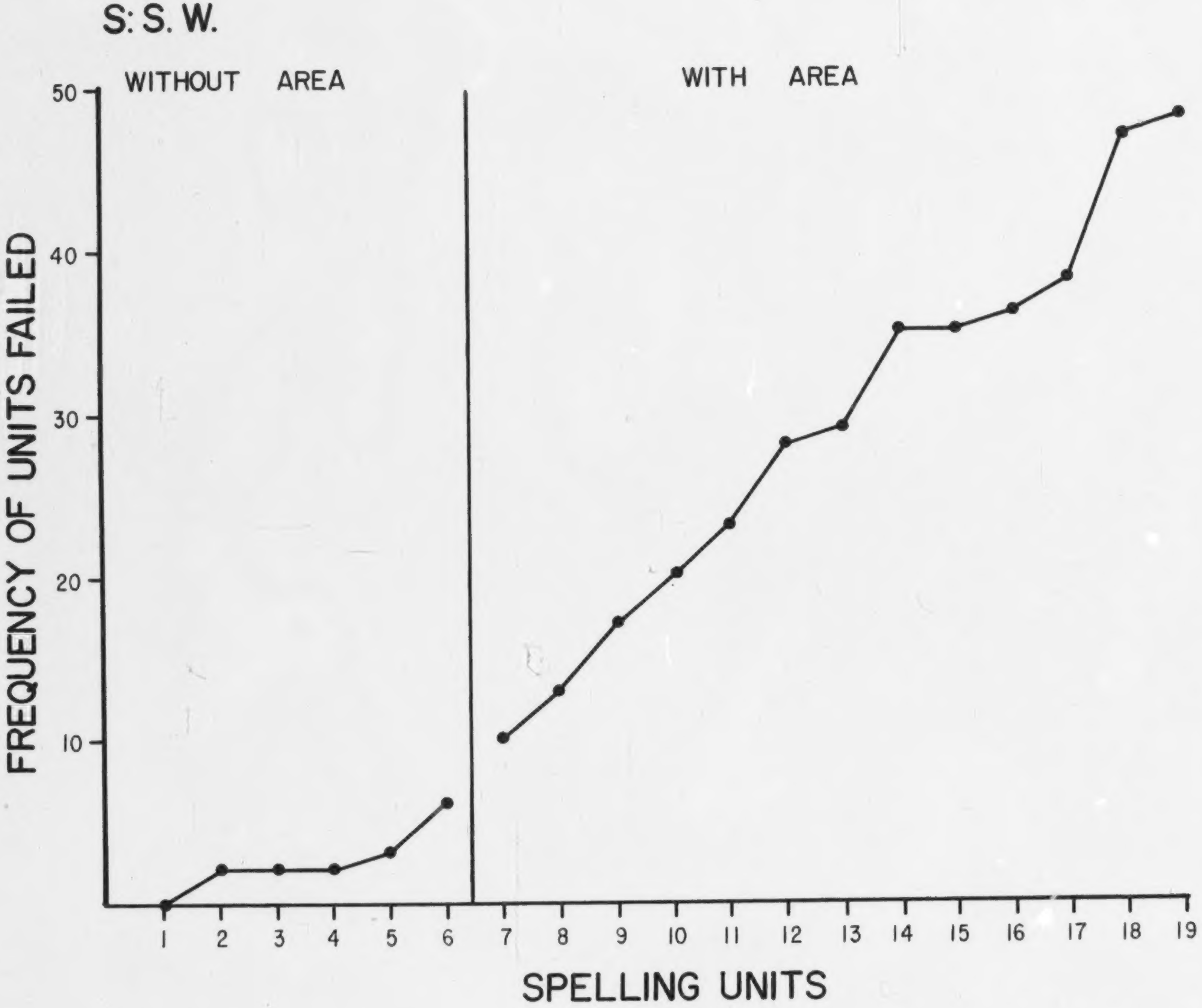
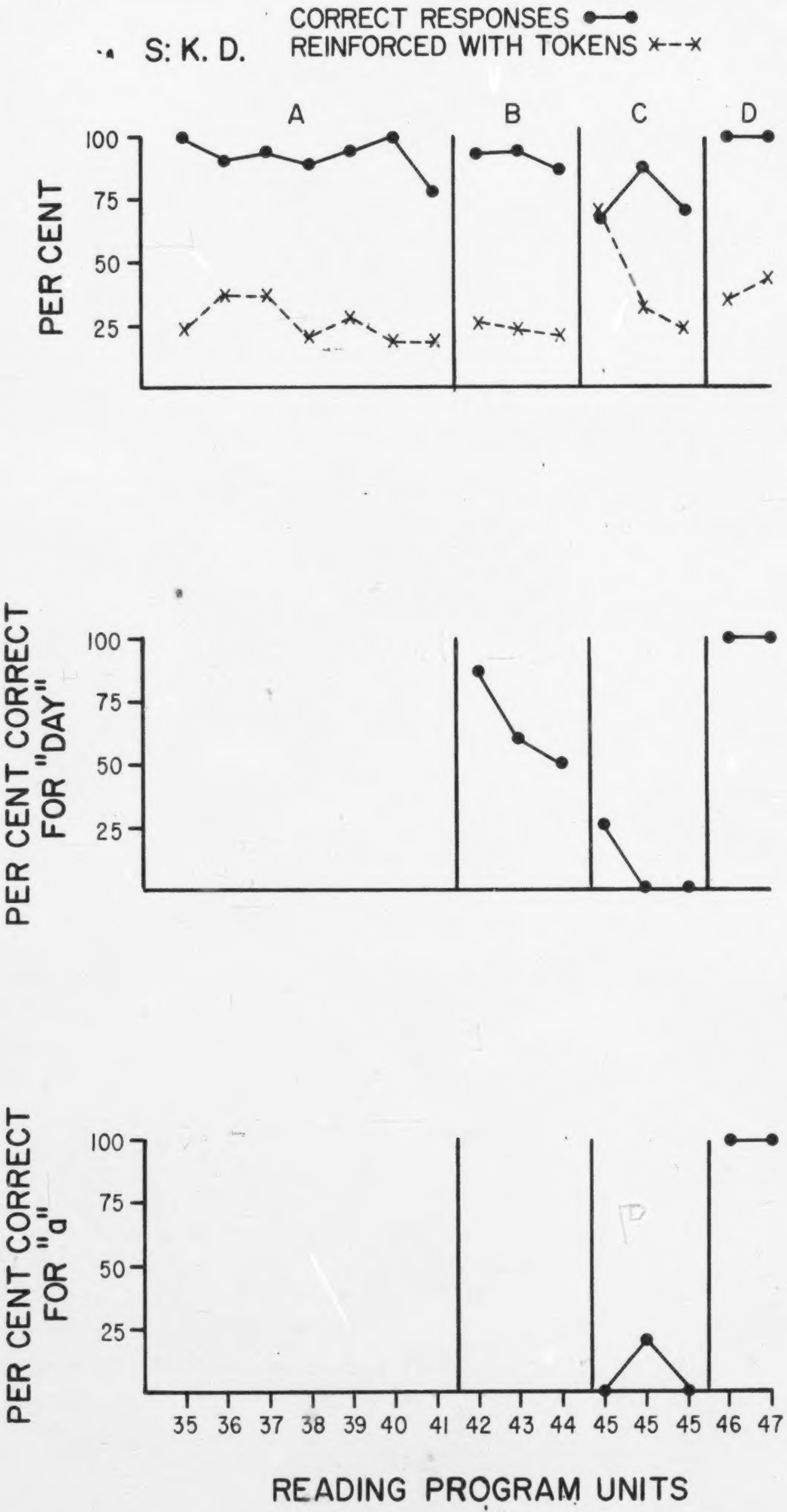

S: S. W.
WITHOUT AREA
WITH AREA
FREQUENCY OF UNITS FAILED
50
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
SPELLING UNITS

Figure 10-2


S: K. D.
CORRECT RESPONSES ●—●
REINFORCED WITH TOKENS ×--×
A
B
C
D
PER CENT
100
75
50
25
PER CENT CORRECT FOR "DAY"
100
75
50
25
PER CENT CORRECT FOR "a"
100
75
50
25
35
36
37
38
39
40
41
42
43
44
45
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45
46
47
READING PROGRAM UNITS

Figure 10-3

shows that K.D.'s performance on oral reading and comprehension tasks was generally accurate and stable after 41 units of the reading program. Unit 42 introduced and concentrated on the word "day." Units 43 through 47 each introduced a new word but provided systematic reviews of "day." The "B" portion of the overall-per cent-correct curve shows that no major difficulties were apparent in Units 42, 43, and 44. However, the function representing accuracy for the word "day" (middle graph) shows that K.D.'s performance on the reviews of the word declined to 50% in Unit 44. Previously, during the administration of Units 37 through 44, an attempt had been made to decrease the frequency of reinforcement with marks. This is represented by the dashed curve in the upper graph in Figure 10-3. (The frequency of teacher approval for correct responses, rather than marks, varied between 96% and 100% for all the reading units shown, and thus has not been plotted.) On the assumption that this decrease in reinforcement with marks might be the condition that decreased K.D.'s accuracy, the frequency of pairing was increased with the introduction of Unit 45 (the first data point in C of the upper graph of Figure 10-3). However, accuracy for the review of "day" declined even further, and K.D. failed to acquire the new word "a" as shown in the lower graph of Figure 10-3. She was given Unit 45 again on the following two days and, as shown in the lower graph, again failed to meet the criterion. It was noted that K.D. usually responded with a verbal "day" to the written word "a" and vice versa. Accordingly, a short remedial unit was constructed that (1) emphasized discrimination between the written "a" and "day" and (2) utilized a much-condensed version of the normal transition from the reading-discrimination task to the oral-reading task. This remedial unit proved to be successful and K.D. moved on to the next regular reading units - 46 and 47. The D portion of Figure 10-3 shows K.D.'s overall accuracy (upper graph), her accuracy for the review of "day" (middle graph), and her accuracy for the review of "a" (lower graph) were all at 100% during Units 46 and 47.

Assessment at the End of the School Year

If the teacher has completed the initial assessment of the child and has systematically recorded changes in materials, procedures, contingencies, and behaviors throughout the year, the task of assessment at the end of the school year is relatively easy. The Laboratory teachers first re-administer the standardized tests. Comparison of final scores with initial scores provides a gross overall measure of academic achievement and behavioral change. The full extent of the changes resulting from the actual formal and informal instructional materials used may not, however, be adequately sampled in these tests. Standardized test results may be useful to principals and school psychologists but they are not necessarily helpful to the child's next teacher who is faced with the practical problems of curriculum design.

The Laboratory teachers also determine the child's terminal mastery level in each of the academic programs by re-administering the general program pretests. Information from these instruments can be incomplete for academic skills that were acquired during the year may not have been pretested. For example, arithmetic behaviors are usually sequential, one building upon another. Children who fail a unit of the Arithmetic Program pretest never pass a higher unit. Thus there has been a tendency for the teacher to stop pretesting at the failure point. However, skills may be introduced, as the child progresses through the program, for which he has at least the minimum repertory.

Finally, the child's problem behaviors as described in the original reason for referral are reassessed. Frequency of occurrence measures are usually employed for this purpose.

The Teacher's Final Report

The special education teacher's final report on a child should be written for persons who will next have primary responsibility for him. It should, furthermore, be descriptive of social and academic behavior, and not interpretations of them. Although the report prepared is generally directed to the principal or the school psychologist, it is the child's next teacher who should be the target audience if the child's progress is to be maintained and extended. A summary of the child's social and academic status should include information about his past history since undesirable behaviors which were extinguished during the previous school year may reoccur, particularly when the child is placed in a new and totally different school environment. If the child's new teacher is forewarned, and is trained in behavioral techniques of teaching, she can readily cope with these behaviors at their inceptions. A comparison of a child's status at the beginning of the school year with his present status implicitly answers questions as to why this or that particular behavior is emphasized in the report. A summary of his present status includes a description of what the child can actually do with the skills and knowledge he has. The child's mastery level in each of the academic programs is also described, with additional comments as to whether or not the academic materials and teacher attention strengthen the child's behavior. The terminal contingencies successfully used with the child are described in detail, as are the indications of the child's success in independent study.

Recommendations are generally limited to the academic materials and procedures that have been used with the child, and to the specific techniques that have resulted in strengthening desirable behaviors and weakening undesirable behaviors.

The Special Education Teacher as a Behavioral Assessment Specialist

The emphasis in this chapter has been on the teacher as an active agent in all phases of the assessment process. Little has been said as to why the teacher should assume the role of assessor instead of leaving it to other professionals, namely a psychometrist, school psychologist, or school counselor. The role of the teacher as the sole arranger of the child's learning environment is implicit in the term individualized instruction. To function effectively in that role, the teacher must have as much first-hand information as possible concerning the behavior of the child and his environment. The child is always a large part of his own environment.

11. Behavior Modification Techniques for the Special Class

Teachers, school psychologists, counselors, social workers, and school administrators, for almost as long as schools have been in existence, have been concerned with problem behaviors in the classroom. Rightly so, because problem behaviors, no matter what their form, interfere with the mission of the school, transmitting the culture of its society to the young. It is also historically acknowledged that the methods most often used to cope with the "acting out" variety of problem behavior have been shown to be not only ineffectual but are frequently the origin of other kinds of undesirable behaviors such as social aggression, truancy, vandalism, daydreaming, and anti-academic attitudes. Schools have yet to deal with disturbing problems in the classroom in a way that can be considered constructive for both the school as an essential social institution and the child. To achieve this objective, procedures should be used which weaken or eliminate problem behavior yet are free from detrimental "side-effects," and which, at the same time, strengthen desirable behaviors in ways that maintain and generalize them.

Techniques that weaken or eliminate problem behavior without generating undesirable secondary effects are those that make no use of aversive contingencies. These techniques include extinction, competition, removing the occasion for the response, time-out from opportunities for positive reinforcement, and setting events which inhibit undesirable behaviors. Extinction means ignoring or not paying attention to the undesirable behavior. Competition, frequently called a distraction technique, means arranging a situation in which undesirable behavior does not occur because the child is engaging in some desirable behavior; the desirable behavior competes successfully with the undesirable. Removing the occasion for the response means identifying and removing the immediate stimulating condition. It does not mean punishment to prevent the response from occurring, or the use of physical restraint and restriction. Time-out from opportunities for positive reinforcers mean that, contingent upon an undesirable response, the situation is altered (e.g., the teacher discontinues giving attention, the child is moved from the situation, etc.) so that positively reinforced responses cannot be made. And finally, setting events which inhibit undesirable behavior refer to changes in the classroom (e.g., the appearance of the principal) and in the child (e.g., illness) that repress such behavior for varying lengths of time.

Techniques which strengthen behavior so that they will be maximally maintained ("retained in memory") and generalized in and out of the classroom are those involving positive reinforcers which are natural and intrinsic to the situation (e.g., it's fun to be in the class; reading is an enjoyable activity.). Children who do not respond to the natural and intrinsic reinforcers of the classroom culture should have, as part of their individualized cirriculum, experiences which help them develop these incentives. It will be recalled that creating new reinforcers (e.g., new interests) is the problem alluded to in Chapters 7 through 10.

This chapter deals with some of the specifics involved in applying behavior modification principles to problem behaviors in a class of young school children with developmental and emotional problems.

Programming the Target Behavior

Technologically, changing problem behavior is no different from teaching an academic subject. Both require arranging conditions and contingencies of reinforcement to expedite learning. In teaching an academic subject like reading, the material is sequenced in some formal way, and the procedures for helping the child are given in explicit form. In modifying behavior, on the other hand, the steps are also sequenced but, as a rule, they are not formally written out point by point, and the procedures for helping a child substitute one form of behavior for another are in general, and not specific, terms. Both sets of techniques are the same in that they require (1) a specification, in behavioral terms, of the target behavior, (2) assessment of the present relevant behavior repertory, (3) planning the treatment sequence, (4) assessment of progress, and (5) successive revisions of the sequence as they are indicated.

The behaviors subject to behavior modification may be grouped into two categories: (1) behaviors that are precurrent to learning academic subjects, and (2) social behaviors prescribed by the classroom culture. We shall elaborate on each in turn but first we shall discuss the problem of contrived reinforcers, since positive reinforcement, which includes both contrived and natural reinforcers, is foundational to most of the techniques discussed here.

The Establishment and Removal of Contrived Reinforcers

As indicated above, in a behaviorally oriented classroom, it is essential that academic and social behaviors be strengthened for the most part by means of positive contingencies. This objective may be accomplished by establishing the proper setting factors and by making certain that the reinforcers in effect are, in fact, functional for each child. As was pointed out in Chapter 5, the discussion of behavior principles, the physical characteristics of the classroom may contribute to a positive setting for work, but by far the most important feature is the daily behavior and basic attitudes of the teacher.

In Chapter 10, on behavioral assessment, it was stated that: (1) the entrance evaluation for each child should include procedures for evaluating the reinforcers that are functional for him, and (2) the effectiveness for the reinforcers identified for each child should be evaluated from time to time during the school year. It is well known that the special education teacher finds that many of her pupils are not sensitive to the usual positive reinforcers dispensed in the regular classroom. Almost all of these children have had an unusual history in one way or another, and school and school learning are generally aversive or neutral (uninteresting) for many of them. As a result, it is often necessary to establish a contrived reinforcement system (token economy or a point or mark system), not only to strengthen the academic and social behaviors in the curriculum but to re-establish the reinforcing properties of the contingencies ordinarily in use in the regular classroom and in society at large.

For a contrived reinforcing system to be effective, the teacher must know how to introduce it, how to keep it vital and functional, and how to remove it when it has served its purpose. Introducing this system to a child is a matter of following the principle of progressive approximation, giving the child ample opportunity to earn marks, allowing for frequent exchanges of marks for "goodies" at first, and gradually increasing the time and number of marks required for exchanges. Keeping the system functional requires continual monitoring (surveying) by the teacher of the children's behavior in relation to the exchange items to make certain they are always in high demand and are always attainable. Removing the contrived system after it has accomplished its purpose requires the "thinning" of reinforcement schedules, particularly the schedule that describes the percentages of time in which marks and social contingencies occur jointly. If the "thinning" of schedules is properly engineered, the child's school performance and general conduct should remain about the same, with or without the mark system. Data evaluating the effectiveness of procedures used to eliminate the mark system were gathered on two samples of children, one from the 1969-70 classes, and one from the 1970-71 classes.

In the first study (1969-70), the subjects were eight children and the data collected were on-task behavior, inattention, and disruption. These behavioral terms were defined as follows: on-task behavior - eye contact with the teacher or the activity, five or more seconds out of a ten-second observation period, and the child in his seat; inattention - eye contact with the teacher or activity for less than five seconds; and disruption - out of seat, away from activity, and talking out of turn. Each child was observed in two activities for 6-minute periods divided into 36 10-second intervals over 16 non-consecutive days, 12 days with marks and 4 days without marks. Average observer reliability was 94.8% for on-task behavior, 78.7% for inattention, and 86.6% for disruption. Table 11-1 shows the mean percent-

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Insert Table 11-1 about here

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age of 10-second intervals, with and without marks, for five of the children, taken at random. Because the mean values tend to obscure

Table 11-1

Academic Performance and Classroom Behavior of Children (1969-70) With and Without Marks

		Mean Per Cent 10-Second Intervals	
Child	Category*	With Marks	Without Marks
D.S.	N	73.7	70.0
	I	10.3	10.3
	D	16.0	20.3
J.H.	N	73.4	85.5
	I	8.4	4.5
	D	8.7	10.0
P.S.	N	92.5	85.3
	I	0.8	2.0
	D	0.8	10.7
K.K.	N	89.4	82.8
	I	4.4	11.3
	D	2.1	6.0
S.W.	N	86.9	86.0
	I	13.1	14.0
	D	0.0	0.0

*N = On-task
I = Inattention
D = Disruption

many interesting details, all the data for three of the children, D.S., J.H., and K.K., are plotted in Figures 11-1, 11-2, and 11-3. It is

- -
Insert Figures 11-1, 11-2, and 11-3 about here
- -

apparent from the data in the table and figures that the removal of marks did not appreciably influence the academic performance or classroom behavior of the children sampled.

In the second study, on nine children in the 1970-71 classes, the same on-task category was used but data were taken on the teacher's interaction with a child when he was on task (NI) and when he was off task (FI). The interactions of the teacher were taken to assess whether she changed her reinforcing practices under the marks and no-marks conditions. In addition, in this replication study an attempt was made to have an equal number of observations for the marks and no-marks conditions. Average observer reliability was 94.1% for on-task behavior (N), 93.3% for teacher interaction with a child when on task (NI), and 93.5% for teacher interaction with a child when off task (FI). Table 11-2 shows the mean percentage for each category with and without marks,

- - - - - - - - - - - - - - - - -
Insert Table 11-2 about here
- - - - - - - - - - - - - - - - -

and Figures 11-4, 11-5, and 11-6 give all the data in graphical form

- -
Insert Figures 11-4, 11-5, and 11-6 about here
- -

for three of the children (C.B., H.G., and M.L.M.) referred to in Table 11-2.

As can be seen, on-task behavior increased for eight of the children, in some instances quite dramatically; it decreased for the other child (M.K.). One possible reason for the general increase is that the teachers reported that they used the available activities and nonexchangeable items more frequently during the no-marks period. If this were the case, the use of marks had a beneficial "side-effect": it sensitized the teachers to extend their use of positive contingencies for progress and appropriate classroom behavior.

Establishing Precurrent Behaviors

The precurrent behaviors for learning reading, arithmetic, writing, spelling, and language are relatively easy to specify. The subjects all share certain common features, such as getting into a

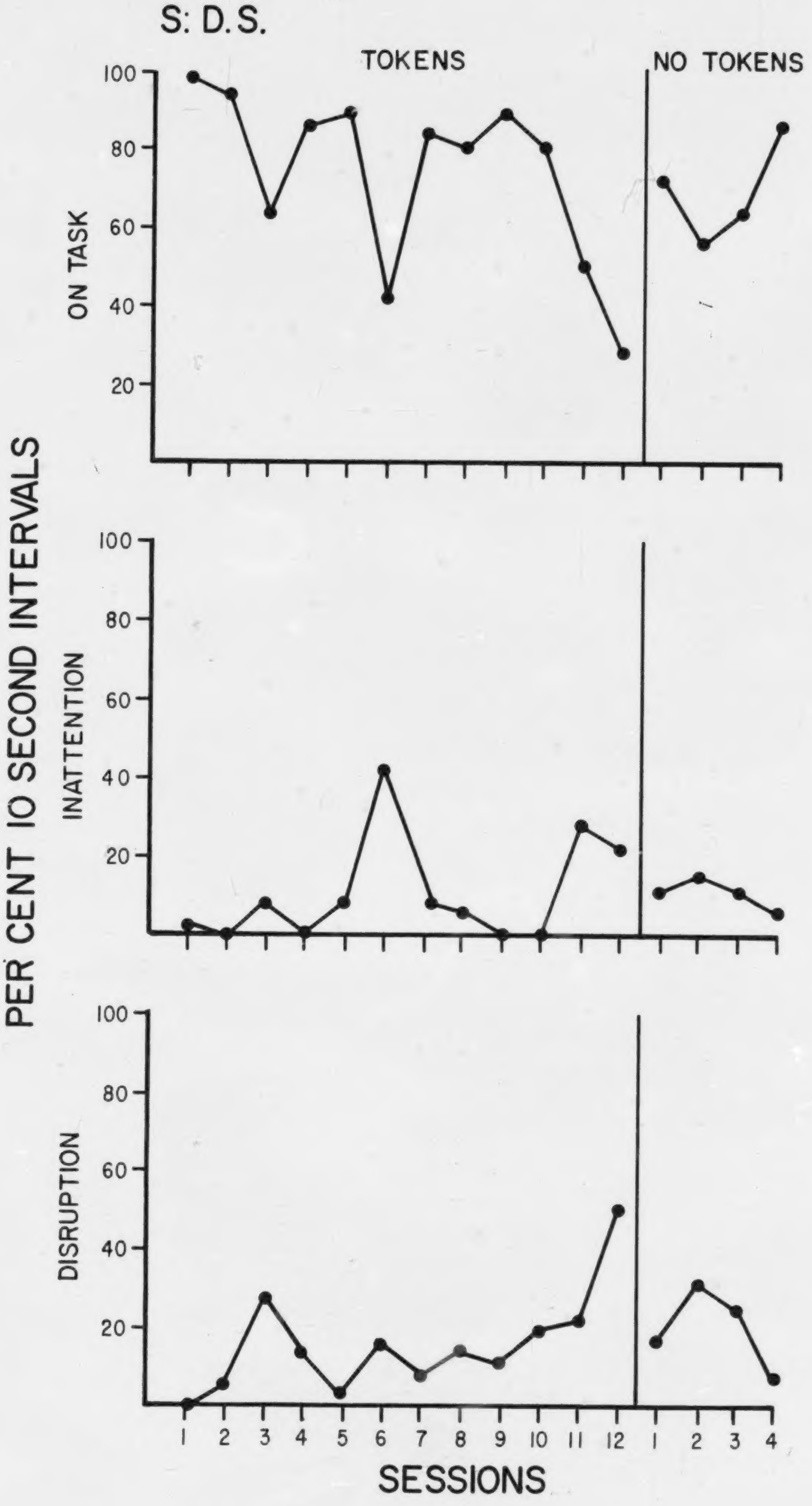

S: D.S.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
INATTENTION
DISRUPTION
100
80
60
40
20
1
2
3
4
5
6
7
8
9
10
11
12
1
2
3
4
SESSIONS

Figure 11-1

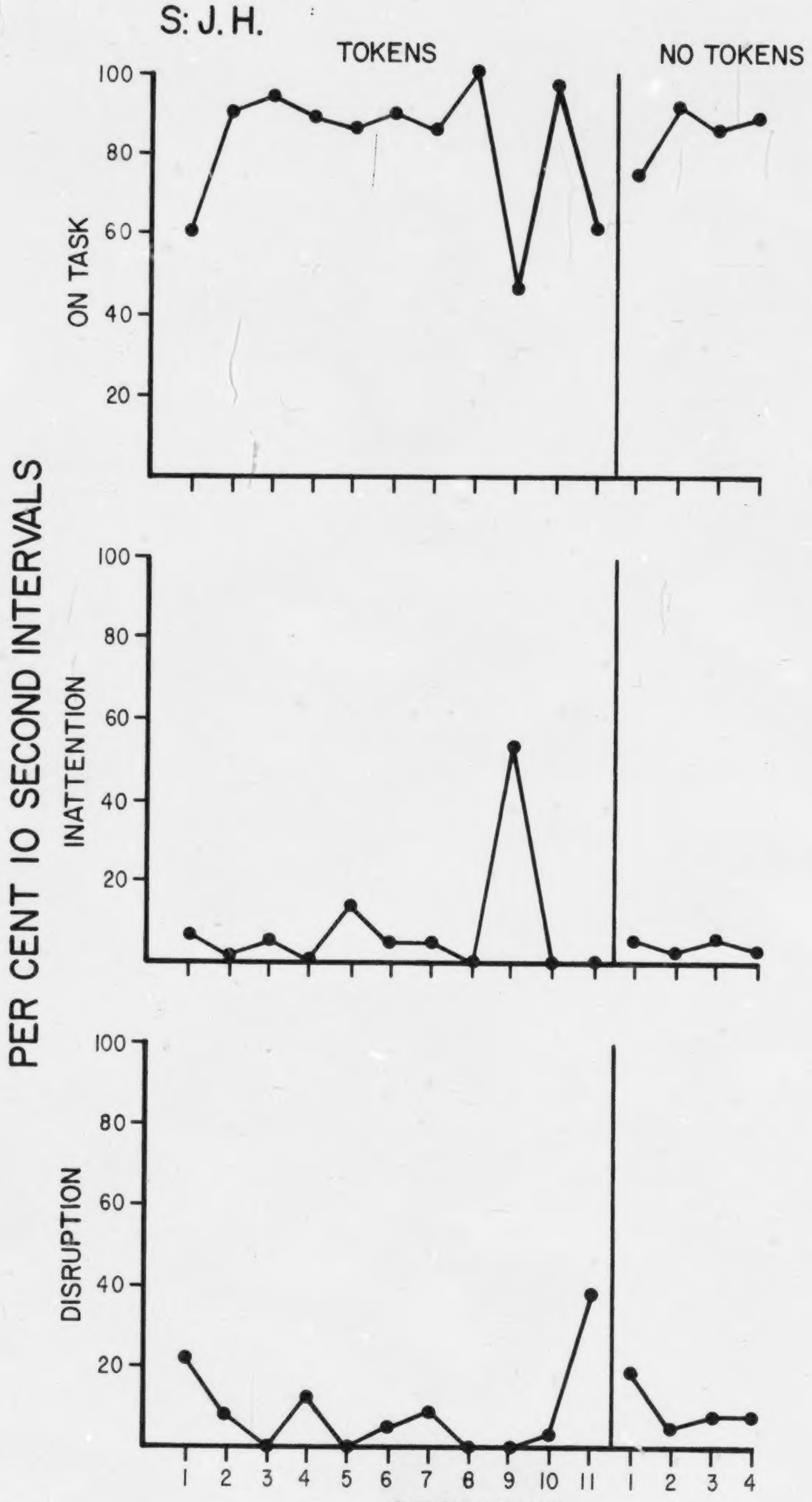
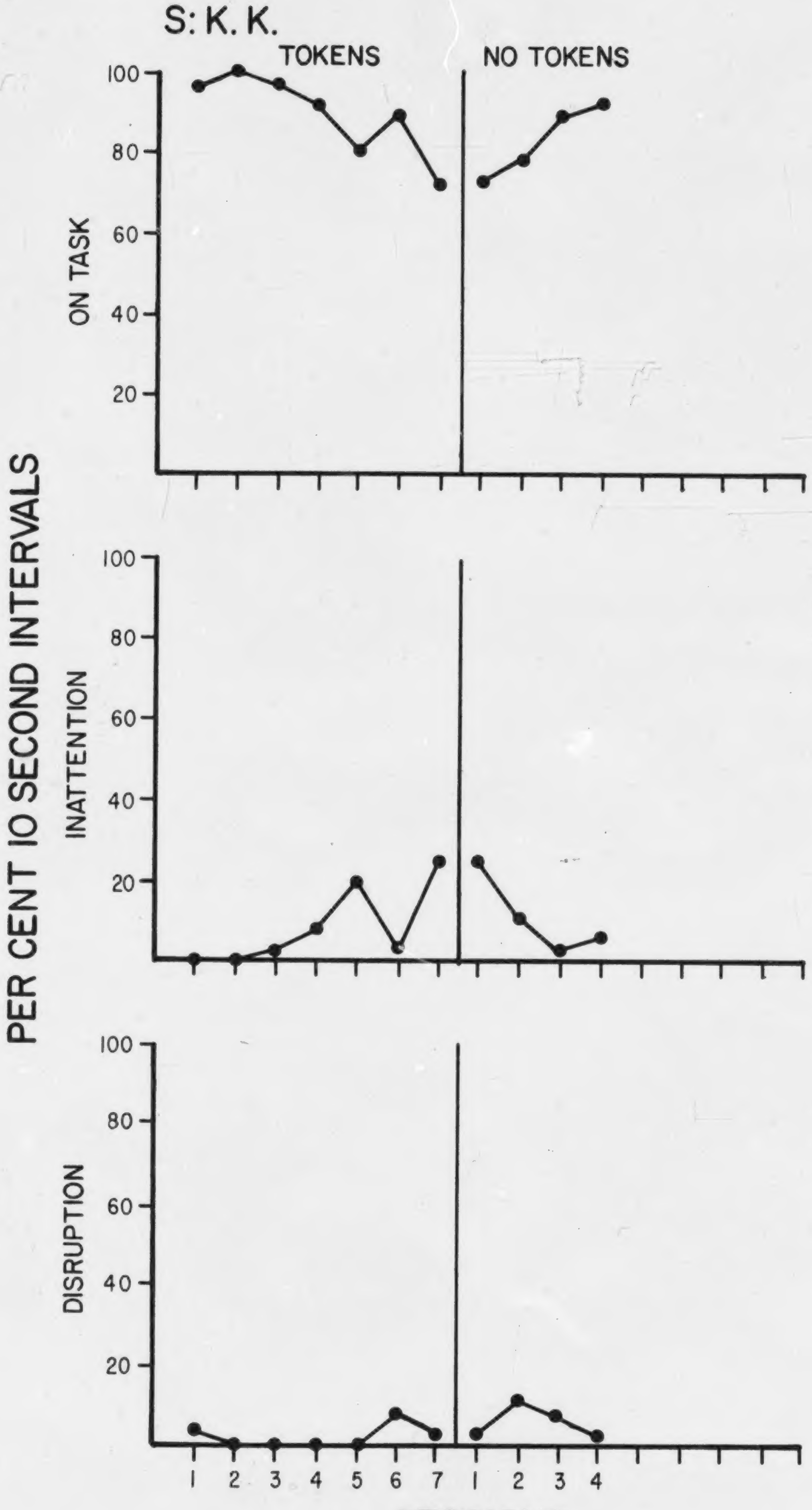

S: J. H.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
INATTENTION
DISRUPTION
100
80
60
40
20
1
2
3
4
5
6
7
8
9
10
11
1
2
3
4
SESSIONS

Figure 11-2


S: K. K.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
INATTENTION
DISRUPTION
100
80
60
40
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1
2
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4
5
6
7
1
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4
SESSIONS

Figure 11-3

Table 11-2

Academic Performance of Children (1970-71) and Interaction of Teachers With Children On and Off-Task

Child	Category*	Mean Percent 10-second Intervals With Marks	Mean Percent 10-second Intervals Without Marks
C.B.	N	74.4	79.4
	NI	36.9	19.7
	FI	0.0	0.0
H.G.	N	51.1	82.3
	NI	26.1	27.6
	FI	8.1	0.0
M.L.M.	N	62.6	97.2
	NI	18.4	36.8
	FI	2.4	6.6
K.D.	N	68.6	83.3
	NI	56.2	55.2
	FI	1.8	17.5
W.J.	N	58.7	59.0
	NI	43.8	14.7
	FI	5.0	.8
K.S.	N	51.4	94.4
	NI	23.3	35.7
	FI	6.6	10.7
G.B.	N	51.8	60.7
	NI	35.2	24.0
	FI	12.7	0.0
M.K.	N	46.7	31.7
	NI	18.7	12.0
	FI	10.1	0.0

*N = On-task
NI = Teacher interaction when child is on task
FI = Teacher interaction when child is off task

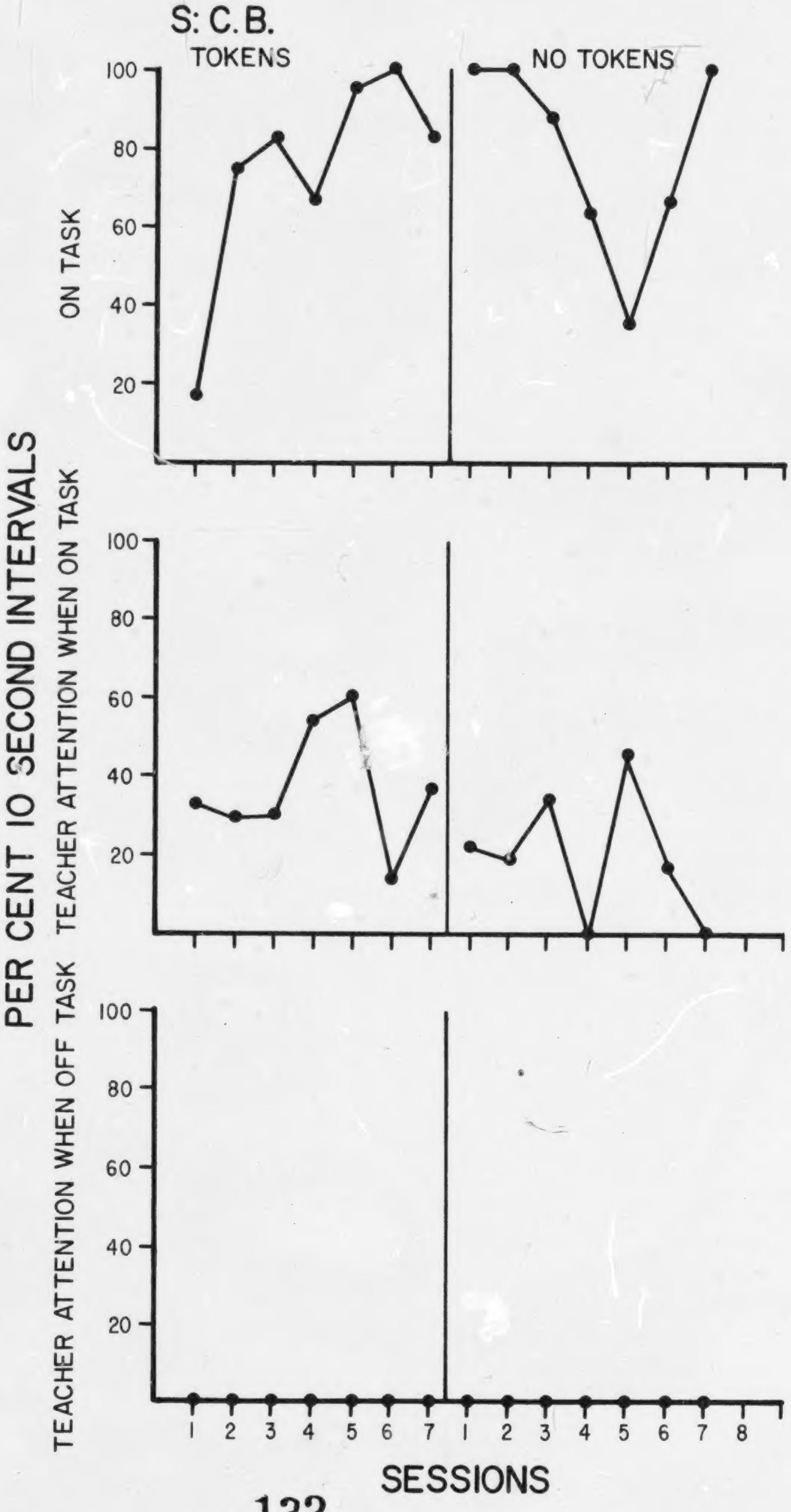

S: C.B.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
TEACHER ATTENTION WHEN ON TASK
TEACHER ATTENTION WHEN OFF TASK
100
80
60
40
20
1
2
3
4
5
6
7
8
SESSIONS

Figure 11-4

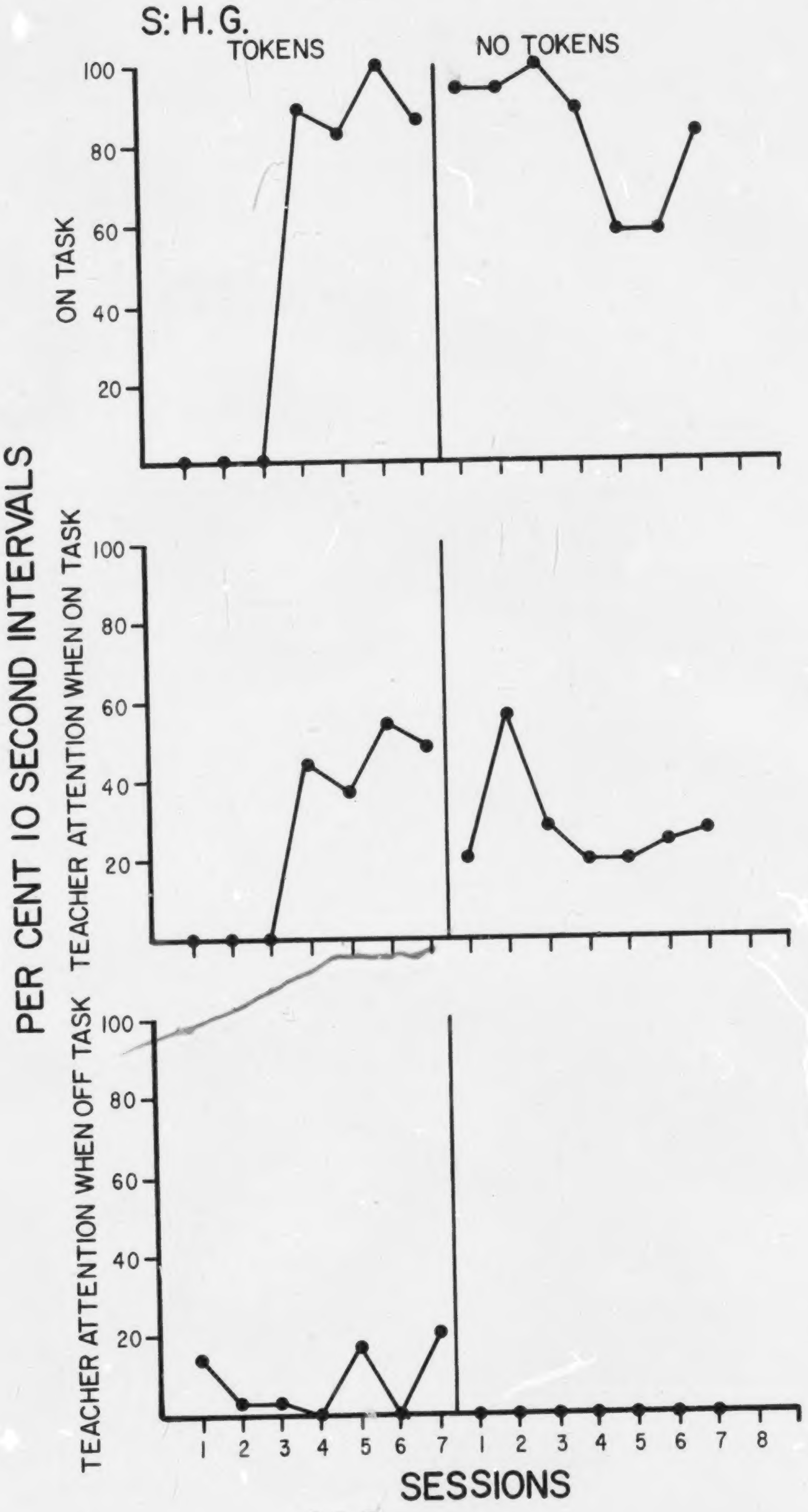
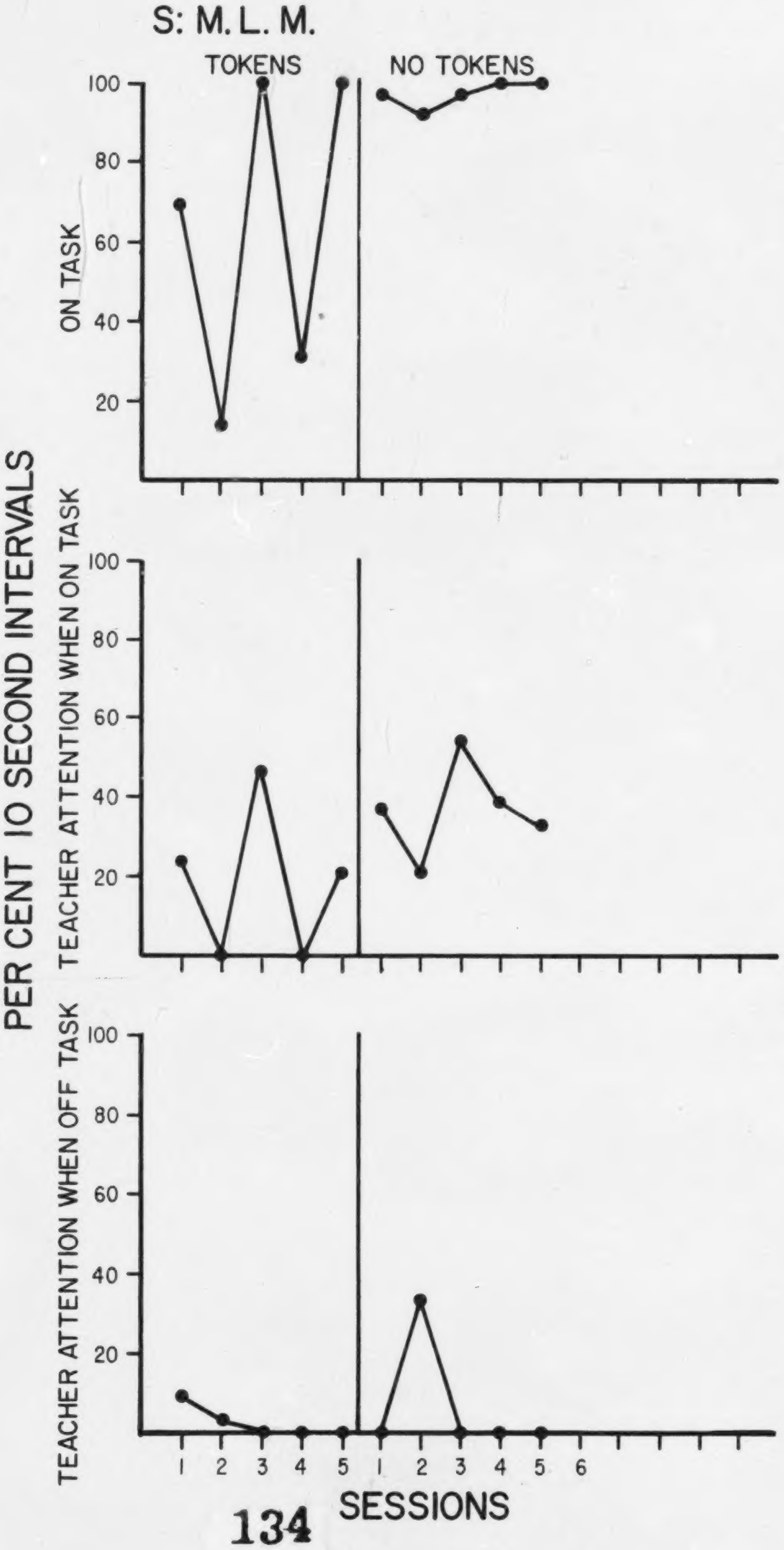

S: H.G.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
TEACHER ATTENTION WHEN ON TASK
TEACHER ATTENTION WHEN OFF TASK
100
80
60
40
20
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
SESSIONS

Figure 11-5


S: M. L. M.
TOKENS
NO TOKENS
PER CENT 10 SECOND INTERVALS
ON TASK
TEACHER ATTENTION WHEN ON TASK
TEACHER ATTENTION WHEN OFF TASK
100
80
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5
6
SESSIONS

Figure 11-6

comfortable position to perform, focusing on the material, etc. At the same time, each has unique properties. The observing skills required in reading and arithmetic are different from one another, and the precurrent manual and verbal behavior for writing and language take very different forms. The reader may recall that in Chapter 7 one component of the precurrent behavior for reading (attending) was described and then developed and presented as a formal program. It is, of course, desirable to have similar programs for the other academic subjects, as well.

The main techniques for establishing, extending, and maintaining the common segment of precurrent behaviors for learning school subjects are the weakening of interfering behavior (1) through extinction (ignoring), or through (2) teacher "time-out" (she looks away, contingent on the child's distractable behavior, and looks back, contingent on resumption of the desirable behavior), and the simultaneous strengthening of appropriate behaviors through (1) stimulus control (e.g., modeling: "I like the way Jimmy is working.") or through (2) positive reinforcement of progressive approximations to the desired precurrent behavior. One other procedure frequently used is the removal of interfering behavior by strengthening competitive desirable behavior. This competition-of-response procedure was studied experimentally during the past year with a thumbsucking five-year-old boy. The investigation is summarized below.

Study of Thumbsucking

Data were collected daily during the 25-minute group language period because (1) pre-baseline observational data indicated the thumbsucking rate was highest during this period; and (2) thumbsucking was incompatible with the oral components of language behavior. The classroom rather than the laboratory setting was selected in order to develop class-applicable procedures. During the language period, the teacher interacted with the eight class members as a unit. She discussed and asked questions about such things as time-telling, the calendar, and ruler use, etc. and prompted, then reinforced, correct answers, using social praise and marks reinforcement system.

Two trained research assistants made 20-minute observations from the classroom's adjoining observation room through a one-way-vision mirror. If the child's thumb came into contact with his lips at all during a ten-second interval, the observers scored the interval as a thumbsucking interval. If the subject was engaged in a specific behavior incompatible with thumbsucking (e.g., sharpening his pencil, writing, raising his hand), the interval was scored as incompatible behavior. A 10-second interval in which neither thumbsucking nor incompatible behavior was observed was scored as non-sucking. Observer reliability, computed for 30 of the 62 sessions, and at least once under each experimental condition, averaged 99+%.

Baseline. During the four baseline phases of the study, the observers simply recorded the occurrences of the three response categories: thumbsucking, incompatible, and non-sucking. There were no programmed contingencies for thumbsucking; the teacher and teaching assistants put no consequences on thumbsucking behavior but, as in all conditions, they reinforced correct responses for academic behavior. In the initial baseline (see A, covering sessions 1-7 in Figure 11-7), thumbsucking occurred

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Insert Figure 11-7 about here

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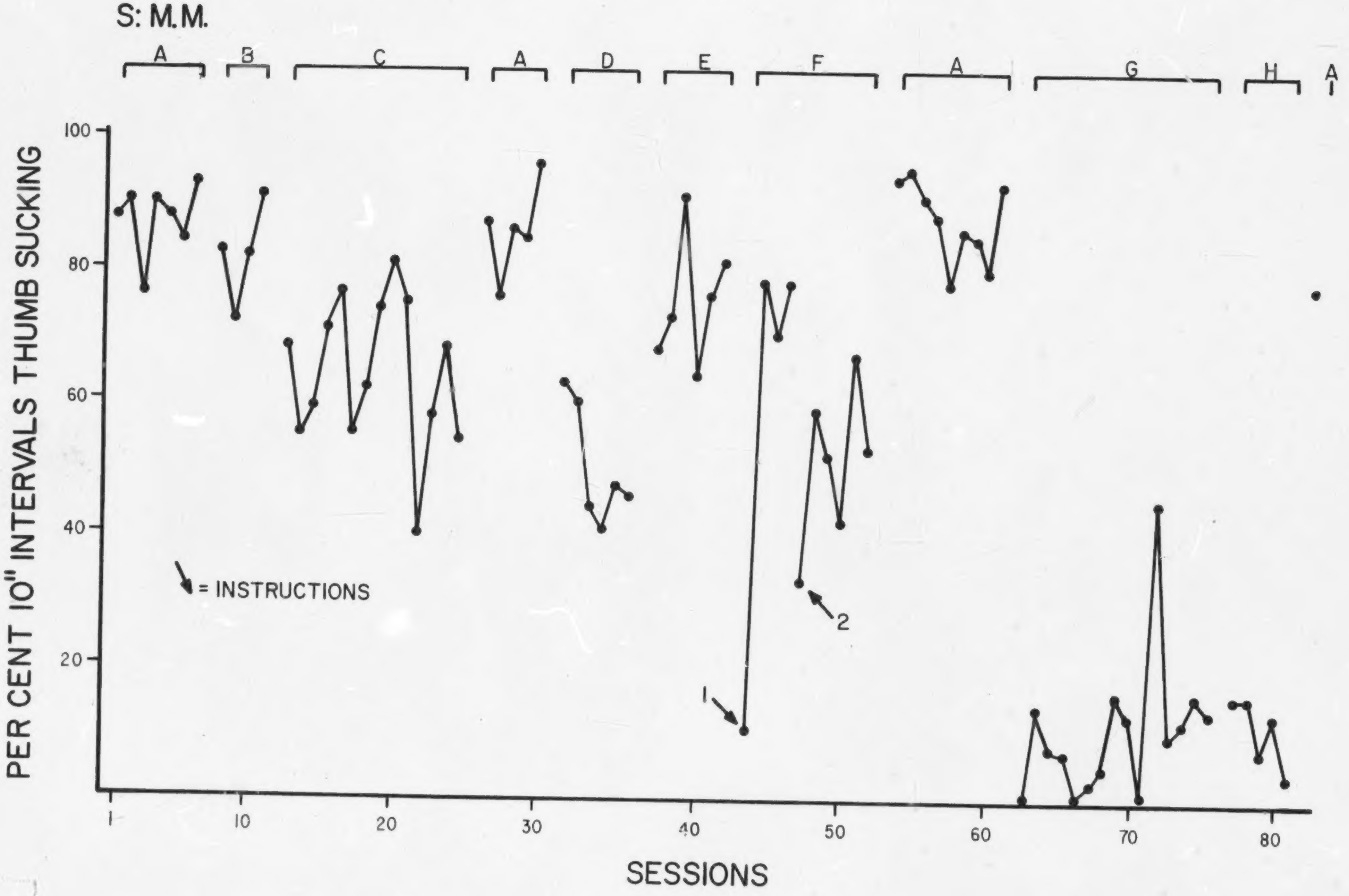
in 87% of the 10-second intervals. Thumbsucking in the other three, interspersed among experimental manipulations (sessions 26-30, 53-61, and 62), will be discussed later.

Reinforcement I: B. Under this condition (B, DRO 10", sessions 8-11), an assistant seated next to the child wrote a mark in his mark book whenever the boy's thumb had not been in contact with his lips for ten consecutive seconds. A tone, operated by the experimenter in the observation room, sounded in the classroom each time the child satisfied the criterion of ten seconds of "other behavior." This tone signaled the assistant to make the mark. After four sessions of no change in the child's behavior, it was apparent that differential reinforcement of *any other* behavior was not functional (DRO 10").

Reinforcement I: C. Under this condition (C, "DRL" - Delay, sessions 17-25), the child received a mark from the sound-signaled assistant for taking his thumb from his mouth. Initially, marks were dispensed after a very short interval (2 seconds), but between sessions 12 to 25, the interval between thumb removal and mark delivery was gradually increased to 10 seconds. The purpose of this interval increase was to lengthen the inter-response time (DRL), but re-analysis of this procedure following session 25 revealed it to be a delayed reinforcement paradigm, not the proposed DRL. The "DRL" Delay schedule resulted in a moderate decrement in thumbsucking (M=64%).

To see whether the delay procedure was reliable, and to establish baseline conditions for the manipulations to follow, reversal of conditions to baseline (A) was put into effect for five sessions (26 to 30). Data in the second baseline period indicated, by the quick recovery of the baseline frequency (M=86%), that the delay procedure had been moderately effective.

Reinforcement I: D and E. Under the next two conditions (D, Mixed FR/RFC-SFD 5" low, sessions 21-36; and E, Mixed FR/RFC-SFD 5" high, sessions 37-42), another response incompatible with thumbsucking was reinforced. An outline of a hand was taped to the child's desk and a "bracelet" marksheet was placed on his left wrist. The child received a mark each time he placed his left hand on the outline and


S: M.M.
A
B
C
A
D
E
F
A
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H
A
100
80
60
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20
PER CENT 10" INTERVALS THUMB SUCKING
= INSTRUCTIONS
1
2
1
10
20
30
40
50
60
70
80
SESSIONS

Figure 11-7

after each successive 5-second interval that his hand remained on the outline. Thus the schedule of reinforcement was continuous, and the reinforcing stimulus (mark) was discrete and occurring every 5 seconds. The hand outline served two purposes: (1) it prompted a specific incompatible response (hand on "hand"); and (2) it provided a specific incompatible response to reinforce.

The mark bracelet was used to prevent the assistant from dispensing a mark in the event the child put his thumb to his mouth immediately following a tone, therefore, eliminating adventitious reinforcement of thumbsucking. Each page of the marksheet booklet contained space for only 6 marks, therefore this condition is labeled (low), meaning a low ratio of marks per page. As shown in D in Figure 11-7, the percentage of intervals in which thumbsucking occurred decreased from 63% to 46% with a mean of 50%. During the final four sessions under this low condition, the child was receiving numerous marks and the low variability of thumbsucking was attributed to satiation of reinforcers within sessions. There were only 5% sucking responses during the first third of session 36, indicating the tendency of the schedule to lose control near the middle of the 25-minute period. The experimenter increased the number of marks required to complete a page (Mixed FR/RFC-SFD 5", high) thereby maintaining availability of the marks but decreasing the frequency of exchange reinforcers. Data presented under E (sessions 37-42) show an abrupt increase in thumbsucking when the number of marks per page was increased.

Reinforcement I: F (Instructions). Under this condition (F, sessions 43-52), the procedures were similar to the previous condition except that (1) the interval between discrete reinforcements was lengthened to require a continuous hand-on-outline response of 15-second duration; and (2) the child received verbal instructions on what to do to get marks and was "led through" the contingency three times at the beginning of two sessions (43 and 47). The pronounced, immediate, and short-lived effects of instructions are shown under F in Figure 11-7. The two arrows indicate the sessions in which the child received instructional reminders (primes). The immediate effect of the instructions was a decrease in thumbsucking due to an increase in the incompatible reinforced response. Sessions following instructions showed recovery of the previous rate of thumbsucking (i.e., he seemed to have forgotten to follow instructions). The return to thumbsucking after instructions was more pronounced on the first priming occasion.

A third baseline period followed the second instructional manipulation and showed an immediate increase, a mean of 53% to the previous baseline level of 67%. This reversal indicated that the effects of instructions were reliable, although they were generally short-lived and sensitive to minor modifications in the situation.

Reinforcement II: General. In this phase of the study, the reinforcing stimulus operated continuously through the use of a small box with a pushbutton, a light, and a cumulative digital timer. Pushing the button turned on the light and started the cumulative digital timer. The box, connected to an electrical apparatus in the observation room, was placed on the child's desk. He was told that if he kept his left hand on the button and thereby accumulated enough time on the timer by the end of the language period, he would receive a preselected toy (similar to a study by Surratt, Ulrich, & Hawkins, 1969). The average time required for a prize was 17 minutes, with a range from 10 minutes to 20 minutes. If he failed to earn enough time, the time he had accumulated was carried over to the next session and the time requirement was increased so that on the second day he would need to meet a larger time quota. Before the start of each session, the experimenter entered the classroom, placed the box on the child's desk, asked him to select a toy, and told him he would receive the toy if the number on the timer was higher than that written on a piece of paper on the box. At the end of the observation period, the experimenter entered the room, and, depending on the accumulated time on the counter, either gave the child his toy, or told him he had not accumulated enough time to get the toy, and could try again the next day.

Reinforcement II: G. Under this condition (G, RFC-SFC, sessions 62-76), the box was wired so that the light remained on and the digital timer accumulated time as long as the child kept the button depressed, unless he (1) was either simultaneously engaged in thumbsucking; or (2) was manipulating the box inappropriately. In the event of either behavior, the experimenter in the observation room could break the circuit operating the digital timer. The immediate effect under this condition was a pronounced drop in rate of thumbsucking to a mean of 10%.

Reinforcement II: H. In this phase of the study (H, DRO-SFC, sessions 77-81), the light and timer ran continuously (SFC) as long as the child's thumb was not in contact with his lips (DRO), or as long as he was not engaged in inappropriate manipulation of the box. As in the previous phase, the experimenter broke the electrical circuit upon either infraction, thus terminating the reinforcing stimulus. The data under H in Figure 11-7 show that the low rate of thumbsucking (M=11%) was maintained with these changes in contingencies.

A one-session reversal to baseline (A) contingencies was carried out in session 82. Figure 11-7 (A) shows that the control exercised by the previous two conditions was temporary; thumbsucking behavior followed the contingencies, returning to 72% of the period's intervals. Further manipulations of the variables were impossible because of the close of the school year.

Several implications are suggested by the results of this thumbsucking study. First, behaviors controlled by strong, unidentified conditions not under the teacher's control can be suppressed by reinforcing incompatible behaviors. Second, contingencies providing continuous reinforcement appear to be much more effective than applying transitory antecedents and consequences (i.e., instructions and discrete events such as marks or tokens). Finally, undesirable behaviors difficult to weaken by extinction procedures (ignoring) may be controlled without resorting to aversive techniques. Behaviors for future study might include "talking out of turn," masturbation, and stereotyped or self-destructive behaviors.

Replacing Undesirable With Desirable Social Behavior

The range of social behaviors which might be considered targets for behavior modification is practically limitless: from training a child to hang up his coat instead of dropping it on the floor of the wardrobe closet as he enters the classroom to establishing cheerful, cooperative behavior in place of fighting and bullying. Unfortunately, many undesirable problem behaviors are unyielding to change, particularly those that are maintained outside of the classroom by peers, parents, sitters, and so on. Perhaps it would be best to comment on the techniques of behavior modification in relation to the severity of the problems.

Severe Forms of Undesirable Behavior

Severe forms of problem behavior include hitting, biting, spitting, throwing objects at a person, pulling hair, damaging property, disrupting another child's ongoing activity, making fun of another child's problem or physical handicaps, and running out of the classroom, play yard, or school building. The most profitable technique of treatment, to date, is time-out from positive reinforcement to weaken the behaviors, in conjunction with positive reinforcement of progressive approximations to the desirable behavior. Application of this technique is not simple for it requires that the time-out behavior categories be specified, that the positive reinforcers used be functional, that the teacher has a general idea of the progressive steps that lead to the desirable behavior, and that the teacher knows how to manage contingencies.

If the behaviors requiring time-out are not clearly designated, it is likely that they would quickly be any form of behavior that displeases the teacher. If the contingencies used in the classroom do not function as positive reinforcers for a child, removing him from opportunities to obtain them does not serve to weaken the antecedent behavior. On the contrary, if the contingencies in the classroom are aversive to a child, the time-out procedure tends to have the opposite effect - it strengthens his undesirable behavior. In the final analysis, a teacher who knows what the progressive steps to the target behavior are and knows how to manage contingencies is a teacher who has been trained to use behavior principles effectively.

Severe problem behavior can also be treated during the child's initial adaptation to the classroom. Problems such as aggression and disruption often do not appear until after the child has been in the special classroom for some time. This "latency", attributable to the novelty of the new situation, can be used constructively by the teacher, who, during this adaptation period, should take the opportunity to strengthen the child's appropriate behaviors, and consequently weaken his undesirable behaviors. An example of the frequency of disruptive behavior during a seven-year-old boy's first 60 days in class is shown in Figure 11-8. Instances of such behaviors are cumulated across school days. As can be seen, the boy did not engage in any form of disruptive behaviors during the first five weeks although entrance information indicated that he had been extremely disruptive in the previous public school classroom. Vigorous reinforcement of desirable behavior during the first five week period might have reduced the frequency of disruptive behavior that followed.

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Insert Figure 11-8 about here

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Mild Forms of Undesirable Behavior

The mild forms of undesirable behavior may be considered to be all of the other forms of undesirable behavior not listed above as severe. They are dealt with by strengthening competitive desirable behavior as mentioned previously. However, most frequently they are treated by extinction or "teacher-attention-time-out" in combination with reinforcement of successive approximations of the desirable behavior. Perhaps it would be informative to give an example of extinction in combination with reinforcement of successive approximations. Suppose a teacher wishes to discourage Johnny from standing aside, off by himself, during play time and encourage him to engage in cooperative play. During the play periods, she watches him closely and reinforces sequentially, and for increasing periods, the following behaviors:

1. Looking at other children

2. Walking in the direction of other children

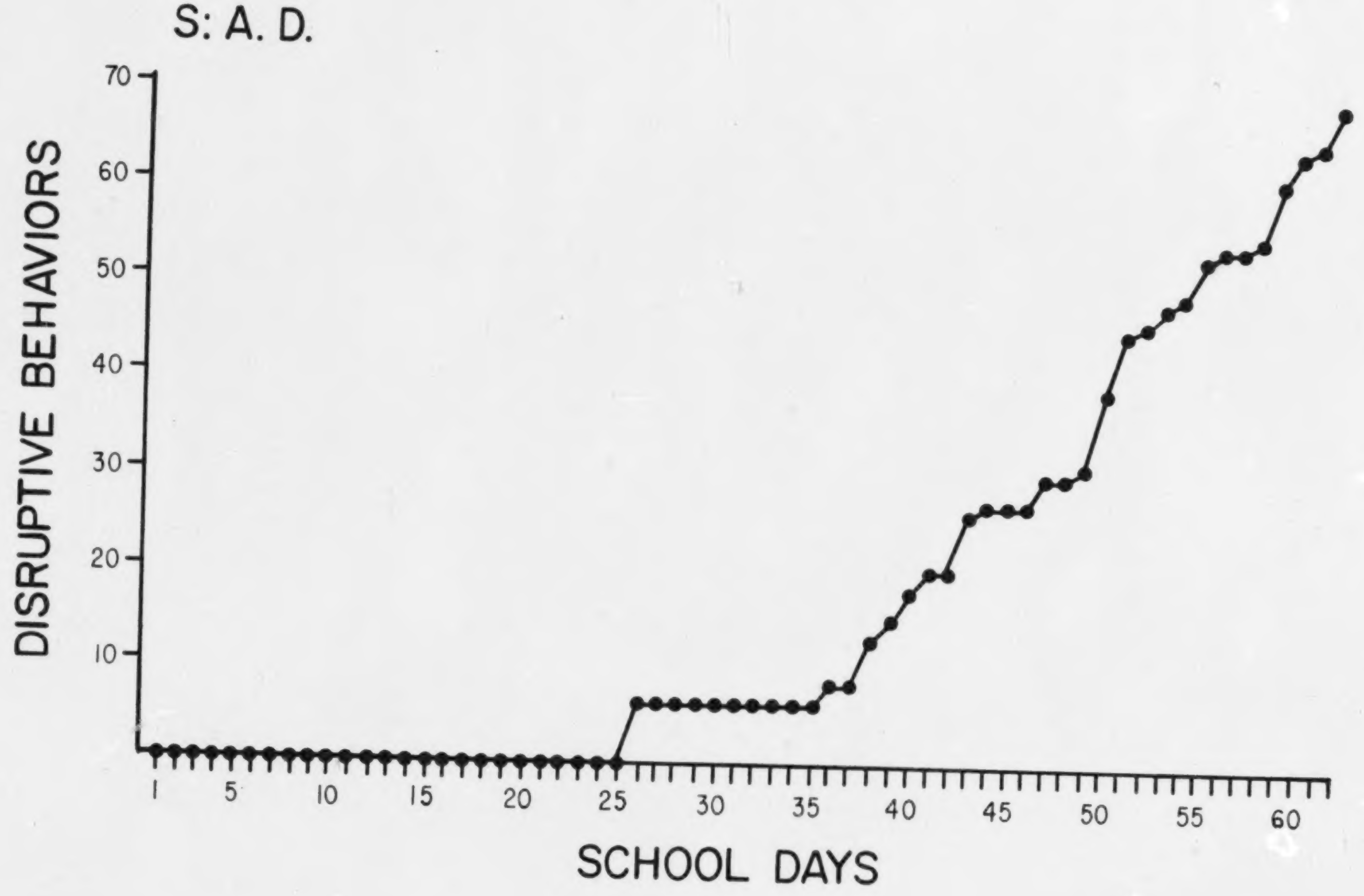
3. Walking near other children

4. Standing and looking at other children

5. Interacting with another child

6. Interacting with another child in a way that may be described as play

7. Interacting with another child in cooperative play


S: A. D.
DISRUPTIVE BEHAVIORS
70
60
50
40
30
20
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1
5
10
15
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25
30
35
40
45
50
55
60
SCHOOL DAYS

Figure 11-8

8. Interacting with another child in any kind of a give-and-take relationship

In many instances, priming and prompting techniques as described in the chapters on the academic programs, are necessary in the behavior modification of mild forms of undesirable behavior because the desired behavior to-be-strengthened is weak, i.e., occurs in low frequency.

12. Training Teacher's Assistant and Working With Parents

Training Teacher's Assistant

Even when she is provided with well-programmed materials and serviceable teaching aids, the special education teacher using behavior principles needs an assistant, a helping hand in preparing each child's assignments and in enhancing the conditions for learning, i.e., making them more functional and more attractive. To be maximally helpful, the assistant should be trained by the teacher with whom she will be working. She should, furthermore, be the kind of assistant who likes children, is highly reinforced when a child makes progress, and is eager to learn new ways of helping children. How the teacher can utilize behavior principles to train her assistant is the concern of this chapter.

The trained assistant is ultimately able to assemble the daily assignments in each subject for each child, to prepare remedial programmed sets, to monitor behavior, to tutor a child in academic subjects, and to supervise small-group learning situations. In general, training begins with a discussion of the manual for teaching reading. (Training of assistants in the Laboratory classes begins with reading merely because it is the best-developed program and because most of the assistant's time will be devoted to teaching reading.) The training then becomes "clinically" oriented. In the first session, the trainee observes a tutor working with a child in reading. In the second, he helps to collect data and assists in the tutoring, and in the third, he takes over the tutoring under direct supervision. If, by the fourth session, he demonstrates his ability to establish a pleasant relationship, to use primes, prompts, and contingencies, and to collect reliable data, he is permitted to tutor, with the supervisor monitoring his performance from the observation room, using a one-way intercom system. Thereafter, he is monitored only periodically. The same general format is used to train the tutor to teach other school subjects, to help the teacher work with small groups, and to prepare programmed material.

Working With Parents

For the child to profit maximally from what he learns in school, and particularly in a special class, parents and other members of the family should take an active role in extending and generalizing the skills and abilities he has acquired. This kind of support is often lacking because of lack of money, motivation, or know-how. The material reported here is concerned primarily with developing techniques to teach the parents how to use some of the teacher's practices.

Informal Studies

Training the parent to help the child in school work follows the general format for training the teacher's assistant. For example, during the past year (1970-71), the following procedure was used to train a mother to help her son (A.D.) with reading. First, she was put through the initial step of tutor training with one of the children in the class who was relatively easy to manage. After Mrs. D.'s performance was approved by the supervisor, she was assigned to tutor her son in the classroom under supervision, and the tutor-training sequence was repeated. Second, after she met the tutoring-skill standard, she was given instructions on carrying out the procedures at home. Under this outside-help regime, the child took home a folder with his reading assignment and material every day. Mrs. D. not only acted as tutor but also kept records on the standard reading program data sheets. The following day, the teacher or tutor entered on A.D.'s flow chart the data on the unit completed at home, worked with him on the next unit, and gave him his next home assignment. The child's steady progress indicated that the mother was working effectively with her son.

The procedure for a second mother was shortened somewhat and had some variations because of the problem behaviors of her son (G.B.). This mother was also given the training for tutors, first with a child who was easy to manage, and then with her son. (It was not necessary to have her repeat the tutor training sequence with her son.) When Mrs. B. reached the stage of working under supervision through the intercom, it was necessary, because of the child's problem behaviors, for the supervisor to give her specific instructions on how and when to reinforce for appropriate behaviors, and to ignore, and to warn her son before using "chair time-out" for behaviors like refusal to respond to requests or questions, crying, and destroying materials. Although she learned to work well with her son in the classroom, Mrs. B. was unable to tutor him at home. In order to extend the mother's training, it would have been necessary for the supervisor to go to Mrs. B.'s home and work with her there. Unfortunately, personnel limitations made this impossible.

Formal Studies

Four formal studies were conducted in the homes of children and were modeled after investigations conducted at the University of Washington and the University of Illinois prior to 1968 (Hawkins, Peterson, Schweid, & Bijou, 1966; and Zeilberger, Sampen, & Sloane, 1968).

The first investigation by Sajwaj and Hedges (1970) demonstrated that the saying of grace at the beginning of dinner had the effects, on a highly oppositional, young, retarded boy, of sharply increasing his disruptive behaviors and decreasing appropriate behaviors during the early part of the dinner hour. It is possible that the saying of grace may have served as a discriminative stimulus (cue) for disruptive behavior. If so, it is also possible that prayer might also have reinforcing or punishing functions. The parents were advised to reexamine the early minutes of the dinner period so that the saying of grace would not serve the purpose of instigating disruptive behavior and making dinner unpleasant for all members of the family.

The second study by Sajwaj and Hedges (1971) was concerned with the "side-effects" of parental punishment and praise in a severely oppositional, retarded child. The disruption recorded included crying, throwing of objects, destruction, aggression, disobedience, self-injury, etc. The appropriate behaviors included handling food, room cleaning, polite requests, answering correctly, etc. Frequency of disruptive and appropriate behaviors were observed daily in five home situations: morning, dinner, tutorial, livingroom cleanup, and bedroom cleanup. The sound of a bicycle horn (105 decibel) was given contingent upon every occurrence of a disruption at dinner only. Disruptions were reduced, and three other changes occurred: (1) appropriate dinner behaviors doubled; (2) self-injury at dinner, though never punished, disappeared; (3) disruptions were reduced, and appropriate behaviors increased temporarily during the tutorial period and livingroom cleanup. Bedroom cleanup and morning behaviors were unaffected. The sound of the horn and praise were therefore introduced, and used successfully in livingroom cleanup and in morning activities.

The third study by Sajwaj, Knight, and Hedges (1971) dealt with the detrimental effects of feedback for errors in a tutoring session with a young retarded boy. In Experiment I, the boy was tutored in a letter and word discrimination program involving 810 frames. Correct matching resulted in a correction ("This is the correct one.") and re-presentation of that frame. The number of errors per session increased. The tutor then ceased giving the correction, and instead waited for the child to correct his errors spontaneously. Errors diminished slowly. The tutor began the correction procedure again, and errors slowly increased. The elimination of the correction procedure used in this situation increased rather than decreased errors. In Experiment II, the father read aloud the name of a body part, and asked the child to point to that part of the body. Each correct response was followed by praise and presentation of the next item. Incorrect responding resulted in a prompt of the item "Point to your arm."). No correction procedure was used. The number of errors per session was above 20. The father then ceased prompting the items and waited for the boy to correct his errors spontaneously. Errors diminished to below 15. The father again began prompting after errors, and the errors increased slightly. When the father again ceased prompting after errors, the error rate fell once again. It seems that prompts from the father had an aversive property.

The fourth investigation by Twardosz and Sajwaj (1971b) focused on the conditions relating to the development of complex sentence structures in a retarded five-year-old girl. Prompts and differential praise and tokens were used in the training. The effectiveness of the mother and a preschool teacher in conducting the learning sessions was compared. The results showed that the teacher was more effective even though both used the same set of contingencies in the same way. This differential effectiveness may have been due to unrecorded differences in praising. Subjectively, it appeared that the teacher praised with a greater variety of words and voice tones, and used more physical contact (patting, hugging) with the child than did the mother. Another possible explanation is the child's past history of reinforcement with the teacher and with the mother. Strict differential reinforcement for desirable behaviors at the preschool may have made the teacher a strong discriminative stimulus for responsive behavior during the sessions. Conversely, the mother may not have been a strong discriminative stimulus for good behavior because of her past inconsistency in reinforcing her child. Although her mother, according to instructions, accurately reinforced good behavior during the sessions, the child may not yet have discriminated that only this behavior would be reinforced by her.

13. Contributions to Research Methods for the Classroom, Playground and Home

Between 1968-71, a series of studies were carried out on the application of behavioral methods to the study of individual children in the natural settings of the classroom, playground, home, residential institution, and the like.

The first study describes and illustrates how behavior analysis may be used to give an account of the behavior of a young child in relation to his parents, siblings, teachers and peers as well as to his physical world (Bijou, Peterson, & Ault, 1968). This approach, which is an alternative to describing behavior in verbal statements (e.g., Barker & Wright, 1949 & 1954), or rating scales (e.g., Baldwin, Kalhorn, & Breeze, 1949), involves (1) specifying the situation in which a study takes place, (2) defining in observable categories the critical behavioral and environmental events, (3) recording the frequencies with which these events occur, (4) estimating observer reliability, and (5) presenting the data in graphic form. These steps are illustrated in a descriptive study of a four-year-old boy attending a university nursery school. The account details the child's sustained activity (on-task behavior) and social interactions during school activities over a period of 28 days. One of the advantages of the frequency category is that it provides data that can be used, without alteration, for an experimental study in the same situation. That is to say, a descriptive study of this type yields an account of behavior that may in turn serve as a multiple baseline for ferreting out which events are functionally related.

The second analysis of research methodology (Bijou, Peterson, Harris, Allen, & Johnston, 1969) delineates a procedure for conducting experiments in natural settings. It outlines the procedure for defining response and stimulus variables, illustrates workable response and stimulus categories, and suggests ways of establishing baselines, manipulating independent variables, and representing findings.

The third analysis shows how the procedures described in the earlier studies above may be used to plan and guide educational, therapeutic, and rehabilitation programs (Bijou & Peterson, in press). Steps are outlined showing how observational techniques may serve to assess the entering repertories of a child (diagnosis), to plan his treatment regime, to monitor his progress, and to assess the outcome of treatment.

The fourth methodological analysis (Bijou, in press) deals with the difficulty of integrating research findings on children in the literature, a problem that is generated by the fact that the methods employed are derived from a mixture of conflicting orientations and objectives. The solution which evolves from the assumptions and practices of behavior analysis would require that we (1) observe directly the interactions of individual children with environmental events, (2) analyze the data collected in terms of frequency of occurrence, and (3) define all technical concepts (e.g., generalization) in terms of functional relationships.

The fifth is a study of a technique for minimizing subject-observer interactions in field settings such as the classroom, playground, and home. Whenever direct observations of interactions are made in natural situations, the observer runs the risk of interacting with the subject and thereby influencing his behavior. For example, children have been known to approach observers, stare at them, attempt to engage them in conversation, kick them, etc. A subtle aspect of a relationship between observer and subject is eye-contact between the two. Eye-contact is frequently the first component of response chains resulting in interaction; eye-contact may serve as a reinforcer for some children. If observer-subject eye-contact functions to evoke or reinforce a subject's behavior, it is a situation that becomes part of the data. For example, if a study were being conducted and the data on off-task behaviors were being recorded, a supposedly "neutral" observer could be influencing at least part of the child's off-task behavior by inadvertently making eye-contact.

The optimal solution to this problem is the use of one-way vision mirrors or video-tape systems. However, these are not always available or may be extremely difficult to arrange. If one were to have an observer in full view and attempted to eliminate the eye-contact problem by instructing the observer to break all eye-contacts immediately, he would find that this procedure results in a loss of data and a decrease in inter-observer reliability. The study reported below describes a technique for making direct observation of a child's behavior while minimizing observer-subject eye-contact and the corresponding loss of inter-observer reliability.

Five girls and four boys ranging in ages from 5-5 to 7-0 served as subjects. Four children were in one Laboratory class and five were in the other. No more than seven children were present in either class during data collection.

Observations were made and data collected on a child's looking at the observer during the writing periods, which were from 18 to 20 minutes long. Data were also collected on the smiling behavior of one girl during the 25-minute language periods for which the class was assembled. Sessions were divided into 10-second intervals. An interval was scored for occurrence of the behavior if the response was emitted at least once during the 10 seconds. In addition, discrete "looking-at-observer" responses were recorded in order to obtain "rate of looks per minute."

Identical pairs of sunglasses, commonly called Air Force mirror or silvered sunglasses, were used during some of the observation sessions. Viewed from the front, the lenses look like mirrors. It is impossible to see the wearer's eyes through the lenses. (The particular glasses used are distributed by Opti-ray but similar glasses can be purchased at any variety or drug store.)

The observers seated themselves in the classroom some 8 to 10 feet from the subject and watched the child's eyes and recorded the number of times the child looked at them during each 10-second interval. They were instructed not to look away when the child looked at them, but to remain "neutral" (i.e., not to gesture, smile, etc.).

During the observations of looking-behavior, the nine subjects were engaged in an untutored writing task with the classroom teacher present and providing individual help when necessary. Each of the nine children was observed for four separate 10-20 minute periods. A child was never observed more than once a day, and no two children were observed simultaneously in the same classroom. Observers wore sunglasses during two observation periods and did not wear sunglasses during the other two periods. Fourteen observers, naive to the purpose of the study, were assigned randomly to conditions (sunglasses versus no sunglasses) and to children. The order of conditions was randomized for all children.

Two trained observers collected data on the smiling behavior of one of the nine children in the study. Data were collected in 10-second blocks and an interval was scored for smiling if the subject smiled at least once during that time. The child was seated at her desk, obstensibly participating in a group language period. Six 18 to 20 minute sessions were conducted without sunglasses with both observers present on three occasions. These sessions were followed by 11 more sessions, with the observers wearing the sunglasses. Inter-observer reliability averaged 92.2% when both observers were not wearing sunglasses, and 95.4% when both observers were wearing sunglasses.

An analysis of variance on the looking data (Winer, 1962) showed a significant difference between conditions ($F = 12.73$, $\underline{P} < .01$) with children looking more frequently at observers not wearing sunglasses ($M = 1.97$) than observers wearing sunglasses ($M = .95$). Figure 13-1

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Insert Figure 13-1 about here

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gives the individual condition means for subjects under conditions with (W) and without (W/O) sunglasses. It shows that the effect upon subject-observer interaction was reliable for all subjects. All subjects looked more at the observers who were not wearing sunglasses.

Figure 13-2 summarizes the data for smiling. The mean percent

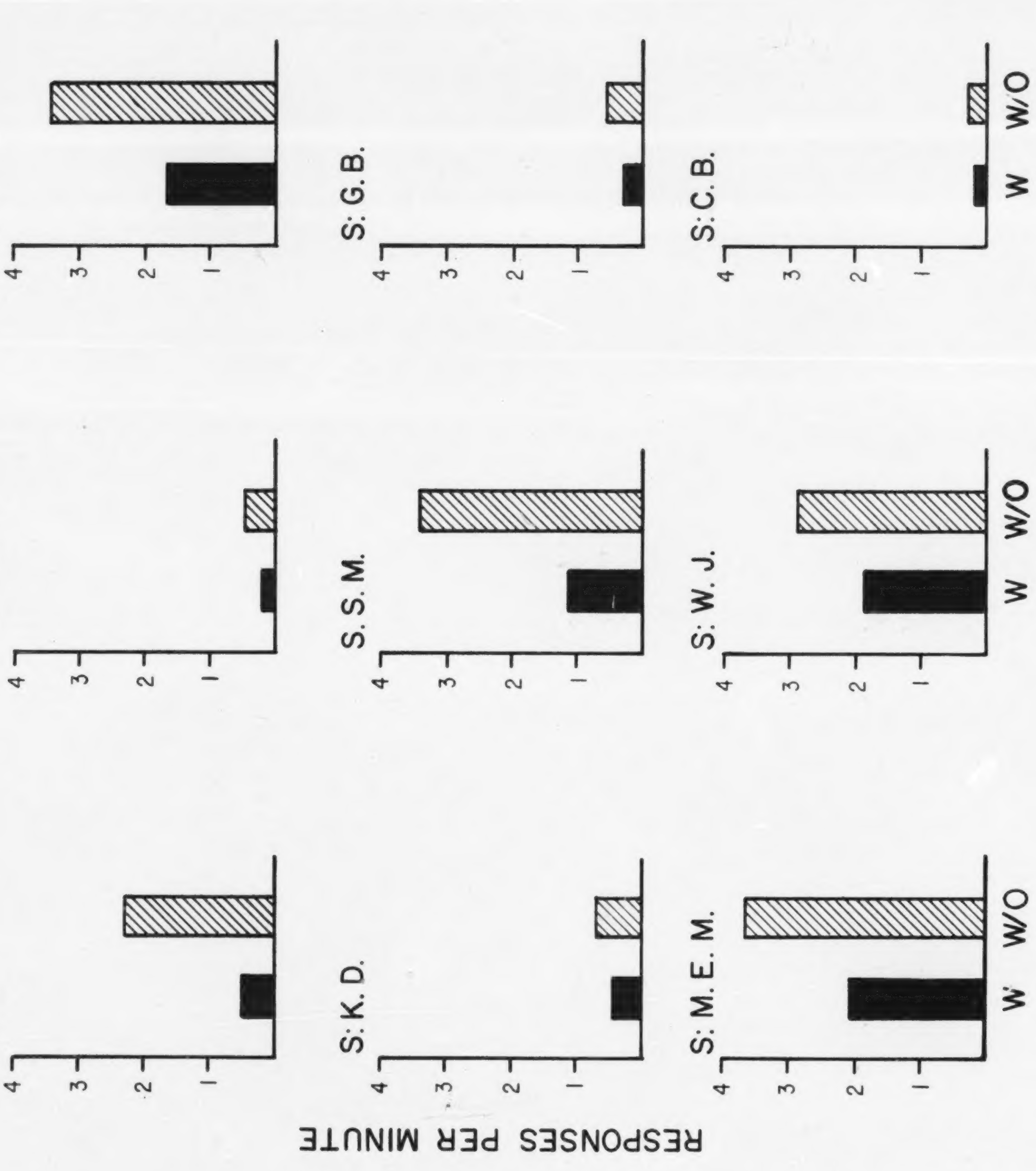
RESPONSES PER MINUTE
S: C.S.
S: M.L.M.
S: M.K.
S: K.D.
S.S.M.
S: G.B.
S: M.E.M.
S: W.J.
S: C.B.
4
3
2
1
W
W/O

Figure 13-1

- - - - - - - - - - - - - - - - -

Insert Figure 13-2 about here

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smiling was 13.7% when observers were not wearing sunglasses, and 8.1% when they were.

The data on looking and smiling behavior strongly suggest that the use of a device eliminating subject-observer eye-contact can be useful in attenuating subject-observer interaction in field settings while maintaining high inter-observer reliability. It is probable that observers wearing sunglasses were more "neutral," perhaps because the elimination of subject-observer eye-contact eliminated a conditioned discriminative stimulus for engaging in interactional behaviors.

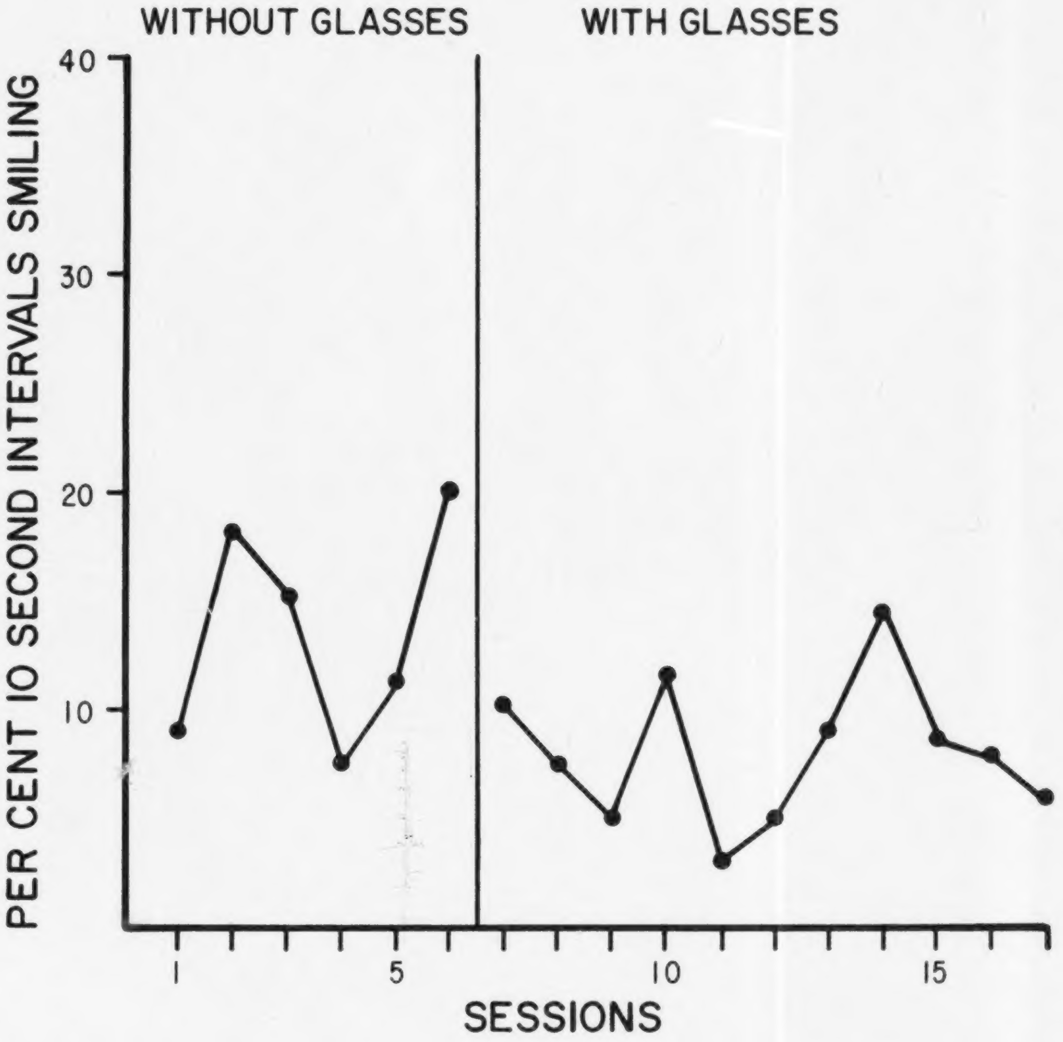
WITHOUT GLASSES
WITH GLASSES
PER CENT 10 SECOND INTERVALS SMILING
40
30
20
10
1
5
10
15
SESSIONS

Figure 13-2

14. Contributions to Developmental Theory and to a Behavioral Technology of Teaching

In this section, we list and summarize the theoretical analyses and technological investigations made during the past three years.

The Behavior Theory of Development

The principles applied to the development of a technology of special teaching came from a behavior theory of human development. The following papers describe the theory and discuss some of its implications.

1. Bijou, S. W. Ages, stages, and the naturalization of human development. American Psychologist, 1968, 23, 6, 419-427.

2. Bijou, S. W. Child behavior and development: A behavioral analysis. International Journal of Psychology, 1968, 3, 221-238.

3. Bijou, S. W. Modern meaning of instincts. In R. B. MacLeod (Ed.), Wm. James: Unfinished business. Washington, D.C., Psychological Association, 1969, Pp. 31-35.

4. Bijou, S. W. Reinforcement history and socialization. In R. A. Hoppe (Ed.), Early experiences and the processes of socialization. New York: Academic Press, 1970, Pp. 43-58.

5. Bijou, S. W. Environment and intelligence: A behavioral analysis. In R. Cancro (Ed.), Contributions to intelligence. New York: Wiley, in press.

Behavior Technology of Special Teaching

The four papers listed below describe studies concerned with improving specific teaching practices in the classroom:

1. Bijou, S. W. Studies in the experimental development of left-right concepts in retarded children using fading techniques. In N. R. Ellis (Ed.), International review of research in mental retardation. Vol. III. New York: Academic Press, 1968.

2. Peterson, R. F., Cox, M. A., & Bijou, S. W. Training children to work productively in classroom groups. Exceptional Children, 1971.

3. Sajwaj, T. E., Twardosz, S., Kantor, N., & Burke, M. Side-effects of extinction procedures in a remedial preschool. Unpublished manuscript, Univ. of Illinois, 1970.

4. Twardosz, S. & Sajwaj, T. E. Multiple effects of a procedure to increase sitting in a hyperactive, retarded boy. Unpublished manuscript, Univ. of Illinois, 1971a.

The first paper is a laboratory investigation with implications for teaching young and retarded children to make discriminations among forms which differ in left-right orientation and rotation in the vertical plane. The programmed sequences described aim to give training on responding to the essential aspects of the forms regardless of their spacial locations.

The second study deals with classroom procedures for grouping children for learning. The contention is that children can work productively in a classroom group if the foundations for the required behavior are first laid in a one-to-one tutorial situation. Two experiments were performed. The first showed that the high rates of learning developed in a tutorial situation were maintained in a group of two children. The second study demonstrated that the high rates of learning developed in single tutorials were maintained in a group of six children.

The third study concerns the multiple effects of reinforcing verbal behavior. The effects of reinforcing the verbal behavior of a seven-year-old retarded boy in a freeplay period was observed both in that period and the following one - the group-learning period (circle time). During the freeplay period, when the teacher attended to his verbal overtures, the boy's verbal behavior toward her increased, his play with toys was more "girlish in character," and appropriate peer behavior decreased. During the circle-time group activity which followed (when no special attention was paid him), his appropriate behavior increased and, conversely, his disruptive behavior decreased. These data suggest that reinforcement of this child's social behavior toward his teacher not only increased the rate of this particular behavior but in the same situation also altered the child's toy-play and peer-play behaviors. That same manipulation, furthermore, resulted in altering the child's behavior in the next class activity. Hence, reinforcement of social behavior in the preceding period was correlated with a higher rate of appropriate group behavior in the succeeding period.

The fourth study, a prompting and differential reinforcement procedure, was implemented to increase sitting in a hyperactive, retarded boy in a remedial preschool. Besides increased sitting, the procedure had the additional effects of decreasing deviant postures and activities, while leaving the rate of normal walking unaffected, increasing the use of toys and proximity to children, and reducing meaningless speech. All of these can be considered socially desirable side-effects of the sitting program. The results suggest that preschool programs can be designed which will treat several behaviors simultaneously, thus maximizing a teacher's effectiveness.

The following four papers deal with the nature and implications of applied behavior analysis, or behavior modification, with respect to the remedial teaching of retarded and emotionally handicapped children:

1. Bijou, S. W. Behavior modification in the mentally retarded: Application of operant conditioning principles. In H. J. Grossman (Ed.), *Pediatric Clinics of North America*, 1968, *15*, 969-987. Also published in Spanish. *Clinicas Pediatricas de Norteamerica, Retardo Mental*. Mexico: Editorial Interamericana, S.A., Noviembre De 1968.

2. Bijou, S. W. Promoting optimum learning in children. In P. Wolf & R. MacKeith (Eds.), *Planning for better learning*. London: Spastics International Medical Publications, 1969. Pp. 58-67.

3. Bijou, S. W. What psychology has to offer education - now. *Journal of Applied Behavior Analysis*, 1970, *3*, 65-71.

4. Bijou, S. W. Technology of teaching young handicapped children. In S. W. Bijou & E. Ribes (Eds.), *Behavior Modification: Issues and extensions*. New York: Academic Press, in press.

15. Conclusions and Recommendations

Granted, that the behavioral technology of teaching handicapped children is still in its formative stage, yet enough work has been accomplished in recent years to demonstrate that it has tremendous potential for helping these children, and should therefore be extended on a broad scale. Based on principles derived from 45 years of laboratory research, the behavioral approach to special teaching will surely become increasingly effective with further advances in basic and applied research.

Conclusions

One conclusion from this research is that special classes should be designed specifically for and limited to kindergarten and primary-age children, classes to which they should be assigned as soon as their problems are identified. These children can and do make commendable academic progress, and can, and do, show rapid improvement in their personal-emotional-social adjustments. Special classes restricted to young children before they become "confirmed failures" serve both a remedial and preventative function.

A second conclusion relates to teaching personnel for the young handicapped child. Since this technology makes individualized instruction mandatory, each child requires more time and attention than a teacher working alone can provide. An assistant is necessary to help her prepare individual programs, conduct tutorials, and keep daily records. It is not necessary for the aide to have a great deal of formal education. She may be a high school or college student, a parent, or a capable, retired man or woman.

The third conclusion bears on the incorporation of these findings into the public schools. School administrators are not expected to model their special classes on the classes described here because the Laboratory classes, although facsimiles of special classes, have, in fact, been designed to facilitate research. Special classes in the public schools would be expected to vary in pupil composition, size, and curriculum in accordance with the policies of local school boards. However, all classes based on the research described here would have certain distinctive features in common: a motivational system based on positive (extrinsic and intrinsic) reinforcers which are meaningful (functional) for each child; individualized programmed instruction in reading, arithmetic, writing, spelling, and language; and teachers who are skilled in arranging conditions and contingencies to expedite academic learning and personal-social adjustment.

The fourth and final conclusion pertains to the teaching of special education teachers. Training potential teachers in the behavioral technology described here requires a college curriculum that has yet to be developed. Because the approach, behavior analysis, is derived from relatively new assumptions and conceptions about human development, attempts to merge a behavior analysis of education with subjects traditionally taught in teacher training courses would only dilute the potency of the technology. A revision of the teacher-training curriculum is obviously indicated. This observation does not help the teacher who has completed her training. She needs training in applied behavior principles and readily available programmed materials and outlines of teaching procedures.

Recommendations

The materials and teaching procedures described in this report require refinements and extensions before making them generally available to special education teachers. The additional work, which would require about two years to complete, would be devoted to:

1. Revising the five academic programs and the reading manual.
2. Preparing manuals for the arithmetic, writing, spelling, and language programs.
3. Expanding the material on individual pupil assessment and preparing it as a teacher's guide.
4. Expanding and detailing the material on behavior modification in the classroom and preparing it as a teacher's guide.
5. Expanding the material on the training of the teacher's assistant and on working with parents and preparing it as a teacher's guide.

There should be, in addition to the above, a follow-up study of the children who were in the program. Such an evaluation, which would assess both the behavior of the child and his interim school history, would shed additional light on the present findings.

16. Bibliography

Baldwin, A. L., Kalhorn, J., & Breese, F. H. The appraisal of parent behavior. *Psychological Monographs*, 1949, *63*, (4), Whole No. 299.

Barker, R. G. & Wright, H. F. Psychological ecology and the problem of psychological development. *Child Development*, 1949, *20*, 131-144.

Barker, R. C. & Wright, H. F. *Midwest and its children.* Evanston, Ill.: Row, Peterson, 1954.

Bijou, S. W. Functional analysis of retarded development. In N. Ellis (Ed.), *International review of research in mental retardation.* Vol. I. New York: Academic Press, 1966.

Bijou, S. W. *Research in remedial guidance of young retarded children with behavior problems which interfere with academic learning and adjustment.* Final Report Project No. 5-0961, Grant No. OEG-32-23-1020-6002, U.S. Dept. of Health, Education, and Welfare, Office of Education, Bureau of Research, Washington, D.C., June, 1968. (a)

Bijou, S. W. Child behavior and analysis: A behavioral analysis. *International Journal of Psychology*, 1968, *3*, 221-238. (b)

Bijou, S. W. The critical need for methodological consistency in field and experimental studies. In F. J. Monks (Ed.), *Determinants of behavioral development*. Amsterdam: Krager, in press.

Bijou, S. W. & Baer, D. M. *Child Development: A systematic and empirical theory*. Vol. I. New York: Appleton-Century-Crofts, 1961.

Bijou, S. W. & Baer, D. M. *Child Development: Universal stage of infancy*. Vol. II. New York: Appleton-Century-Crofts, 1965.

Bijou, S. W., Birnbrauer, J. S., Kidder, J. D., & Tague, C. Programmed instruction as an approach to the teaching of reading, writing, and arithmetic to retarded children. *Psychological Record*, 1966, *16*, 505-522.

Bijou, S. W. & Peterson, R. F. The psychological assessment of children: A functional analysis. In P. McReynolds (Ed.), *Advances in psychological assessment*, Vol. II, in press.

Bijou, S. W., Peterson, R. F., & Ault, M. H. A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *Journal of Applied Behavior Analysis*, 1968, *1*, 175-191.

Bijou, S. W., Peterson, R. F., Harris, F. R., Allen, A. K., & Johnston, M. S. Methodology for experimental studies of young children in natural settings. *Psychological Record*, 1969, *19*, 177-210.

Caldwell, B. M. *The preschool inventory*. Princeton, N.J.: Educational Testing Service, 1967.

Dunn, L. M. *Peabody Picture Vocabulary Test*. Minneapolis, Minn.: Amer. Guidance Service, 1959.

Eckerman, D. A., Lanson, R. N., & Cumming, W. W. Acquisition and maintenance of matching without a required observing response. *Journal of Experimental Analysis of Behavior*, 1968, *11*, 435-441.

Ferster, C. B. & Skinner, B. F. *Schedules of reinforcement*. New York: Appleton-Century-Crofts, 1957.

Hawkins, R. P., Peterson, R. F., Schweid, E., & Bijou, S. W. Behavior therapy in the home: Amelioration of problem parent-child relations with the parent in a therapeutic role. *Journal of Experimental Child Psychology*, 1966, *4*, 99-107.

Jastak, J. F., Bijou, S. W., & Jastak, S. R. *Wide Range Achievement Test*. (Rev. ed.) Wilmington, Dela.: Guidance Associates, 1965.

Johnson, G. O. Special education for the mentally handicapped - A paradox. *Exceptional Children*, 1962, *29*, 62-69.

Johnston, M. S., Sloane, H. N., Jr. & Bijou, S. W. A note on the measurement of drooling in free-ranging young children. *Journal of Experimental Child Psychology*, 1966, *4*, 292-295.

Observer, Comments and queries: Wanted, a better direction for linguistic psychology. *The Psychological Record*, 1970, *20*, 263-265.

Sajwaj, T. E. & Hedges, D. The effects of saying grace on the behavior of an oppositional, retarded child. Unpublished manuscript, Univ. of Illinois, 1970.

Sajwaj, T. E. & Hedges, D. "Side-effects" of a punishment and parental praise in an oppositional, retarded child. Unpublished manuscript, Univ. of Illinois, 1971.

Sajwaj, T. E., Knight, P., & Hedges, D. The detrimental effects of feedback for errors in a tutoring program for a young retarded boy. Unpublished manuscript, Univ. of Illinois, 1971.

Sajwaj, T. E., Twardosz, S., Kantor, N., & Burke, M. Side-effects of extinction procedures in a remedial preschool. Unpublished manuscript, Univ. of Illinois, 1970.

Sidman, M. Tactics of scientific research. New York: Basic Books, 1960.

Sidman, M. Reading and auditory-visual equivalences. Journal of Speech and Hearing Research, 1971, 14, 5-13.

Skinner, B. F. Science and human behavior. New York: Macmillan, 1953.

Skinner, B. F. Verbal behavior. New York: Appleton-Century-Crofts, 1957.

Skinner, B. F. The technology of teaching. New York: Appleton-Century-Crofts, 1968.

Surratt, P. R., Ulrich, R. E., & Hawkins, R. P. An elementary student as a behavioral engineer. Journal of Applied Behavioral Analysis, 1969, 2, 85-92.

Twardosz, S. & Sajwaj, T. E. Multiple effects of a procedure to increase sitting in a hyperactive, retarded boy. Unpublished manuscript, Univ. of Illinois, 1971.(a)

Twardosz, S. & Sajwaj, T. E. Development of complex sentence structure in a retarded girl using a multiple baseline technique. Unpublished manuscript, Univ. of Illinois, 1971.(b)

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

Wolf, M. N., Risley, T., & Mees, H. Application of operant conditioning procedures to the behavior problems of an autistic child. Behaviour Research and Therapy, 1964, 1, 305-312.

Wolf, M. M., Risley, T. R., Johnston, M. K., Harris, F. R., & Allen, K. E. Application of operant conditioning procedures to the behavior problems of an autistic child: A followup and extension. Behaviour Research and Therapy, 1967, 5, 103-111.

Wyckoff, L. B., Jr. The role of observing responses in discrimination learning. Part I. Psychological Review, 1954, 61, 89-97.

Zeilberger, J., Sampen, S. E., & Sloane, H. N., Jr. Modification of a child's problem behaviors in the home with the mother as therapist. Journal of Applied Behavior Analysis, 1968, 1, 47-53.

17. Appendix

The Educational History of a Cerebral Palsied Boy With Autistic Behaviors

Since the methodology of the research reported here deals with changes in the behavior of an individual child, a complete account of the problems, procedures, and outcomes for one child might prove clarifying. The subject described below was selected because he posed one of the most difficult problems encountered in remedial education - how to motivate the unmotivated child.

History Prior to Enrollment

S.W. is a cerebral palsied child. He was placed with foster parents at the age of 2¼ years, and remains a ward of the Children and Family Services of the State of Illinois. His history shows an "early emotionally deprived background." There are no other children in his foster home, though a grandmother lives with the family. The foster parents care a great deal for S.W. and have a considerable emotional investment in him.

Prior to enrollment in the Laboratory class, S.W. attended special classes for the orthopedically handicapped at a regular elementary school. He progressed in moving about on crutches to the point where his orthopedic problem was no longer of primary concern. Because he "failed to respond or relate consistently to classroom activities and therapy," he was given a psychiatric evaluation. At that time, his behavior was characterized by (1) sing-song voice patterns or mumbled speech, (2) body and head-rocking accompanied by facial grimacing and flailing of arms, hands, and fingers, and (3) inattention and the appearance of constantly being in a daze. A subsequent psychological evaluation concluded that he was autistic because of his bizarre and inappropriate behavior patterns.

Observations in the home revealed (1) that his foster mother had low expectations of S.W. and made only the most minimal demands on him; and (2) that she reinforced his manneristic behaviors with attention when they occurred frequently.

Several administrations of standardized intelligence tests yielded results that were at best variable and incomplete. The majority of the evaluations read "impossible to evaluate; child uncooperative." The general consensus, nonetheless, remained that S.W. showed at least average intellectual ability (though his general level of functioning may have been lower) and that assessments were low because of a lack of "motivation" rather than ability. Everyone having contact with S.W. reported that he can perform much better than he does.

In the early months of 1969, some behavior modification techniques were implemented in S.W.'s orthopedic classroom for a period of three weeks. During this period, S.W.'s rate of bizarre behavior diminished and his performance in general showed some improvement. It was recognized that a continuous application of these behavioral techniques and one-to-one tutorials might be quite successfully employed with S.W.

Enrollment

In January of 1970, S.W., age 8 years 3 months, was enrolled in one of the Laboratory classes. During the five months of the spring term, he made some academic progress and showed some improvement in appropriate verbal behavior, on-task behavior, and his interest in toys and materials in the classroom. But because he was judged not to have made sufficient advancement in his social and academic behaviors to return to a regular or special class in the community public school, he was re-enrolled in the Laboratory class in September, 1970.

Assessment and program planning. On return from summer vacation, S.W. was described by the assessing teacher as displaying: (1) excessive mannerisms involving the hands, arms, face, head, and torso, (2) negativistic behavior and insensitivity to instructions, (3) extreme dependence on adults and peers, (4) a high percentage of off-task behavior, and (5) lack of general motivation. Each category subsumed numerous specific problems. He spent much time at his desk engaging in manneristic behaviors (e.g., slapping his ears, clapping, wildly shaking both hands). He would not work without constant prompting from the teacher and often seemed to make errors deliberately. He was not making progress in writing because he would not attend to the model; in spelling because he would not write the words without continuous prompting; and in arithmetic because he would not attend long enough to count objects in order to match sets and numbers. He was moving ahead slowly in reading though requiring excessive amounts of social reinforcement to stay on task. Often he would put his head down on the desk and ignore the teacher or tutor.

The starting point of educational treatment, because it seemed the most far-reaching of S.W.'s problems, was his lack of motivation. There seemed to be no reinforcer, social or non-social, that was functional in keeping him on task in any of the school activities. Without effective reinforcers, the probability of increased on-task behavior was low, and further advances in behavior modification impossible.

After deciding to concentrate on the development or discovery of effective reinforcers, the teachers thought it best to plan his program so that he could move rather quickly through the academic subject-matter without stressing the need for independence. Training in working independently could easily be given once some academic competence was attained.

Individual tutors, mainly students, were assigned to work with S.W. in the reading, arithmetic, writing, and phonics programs. He worked independently on spelling with the aid of a teaching machine and he participated with the other children in the group oral language period, and in such routines as snack-time and recess. Except for having individual tutors, S.W. proceeded through the same programs as those given the rest of the class; no modifications of content or sequencing of material were necessary.

Procedures for developing functional reinforcers. S.W. worked under the same mark system as the other children, receiving marks for correct responses or appropriate social behaviors. The marks were accumulated and later exchanged for back-up reinforcers (e.g., candy, the opportunity to participate in an activity, etc.). Unfortunately, the marks and back-ups given contingently had little effect on his academic and social behavior. Technically, marks were not reinforcers for S.W. since they did not increase the frequency of appropriate responding. He invariably exchanged his marks for bubble gum or, occasionally, on a plastic figure. In spite of the ineffectiveness of the mark system, it was continued, with each mark accompanied by some social reinforcer.

One of the tutors helped S.W. make good progress on the reading program. Compared with other tutors, this tutor showed an almost grotesquely over-exaggerated enthusiasm for each of S.W.'s correct responses (e.g., loud, dramatic verbalizations and gestures; vigorous hugging, etc.). The other tutors working with S.W. were encouraged to adopt this hyper-enthusiastic form of social contingency. With this change in style, social reinforcers became appreciably more effective, though they were still far from adequate in themselves.

Shortly after the Christmas vacation, a new type of reinforcement was explored. A separate section in the water-play room was set aside as S.W.'s private area, where he kept some toys chosen from the classroom and some he had brought from home. It was his own special province. He was allowed from 5 to 10 minutes of free play in the room whenever he completed an assignment in less than the specified time. This procedure was fairly effective at first, so the standards of performance and the amount of work required within the designated period were gradually increased. After several weeks, however, behavior reinforced by access to the playroom began to decrease, indicating satiation with activities in the playroom.

April brought the rather serendipitous discovery of a variety of reinforcers for S.W. Quite by accident, one tutor found that S.W. was extremely persistent at a behavior which was followed by tickling. Tickling was then used as a consequence for correct responses on the arithmetic program. Allowing S.W. a few seconds to look at the scar on the neck of another tutor also proved to be a functional reinforcer. At this point, each tutor was encouraged to develop his own form of social reinforcement to accompany the delivery of marks. In addition to tickling and a chance to look at the scar, the following were effectively used to keep S.W. on task and to progress academically: (1) allowing S.W. to draw a picture and show it to the class, (2) allowing him to read his own books after finishing his reading assignments, (3) extended conversations between S.W. and the tutors, and (4) allowing S.W. to tell the tutor a story he composed. Since he was often distracted from his work by the presentation of these unusual reinforcers, reinforcements were administered for increasingly large segments of work (for completion of a page of arithmetic rather than for a single problem). S.W.'s academic progress throughout the year, which is reported below, testifies to the fact that functional reinforcers were discovered, developed, and effectively applied.

Procedures for the development of independence. Early in the school year, S.W. was able to do the spelling assignments independent of assistance from teacher or tutor. This independent behavior was, of course, highly reinforced, and continued throughout the year. It served as a cue to the teacher to also present other assignments in a way that would promote more independence. Directions were kept simple and explicit since S.W. often had difficulty in following instructions. The high degree of prompting used when introducing new material was faded as S.W. became more proficient at the tasks. A greater degree of independence was also achieved by having tutors "thin" their reinforcement schedules so that larger and larger units of work were required for reinforcers.

Toward the end of the school year, a probe was made which required S.W. to do his writing assignments independently. The result was a performance far below his normal level of behavior. Similar deterioration of performance was noticed when, for a short time, he was required to work on the arithmetic program without a tutor. S.W.'s inability to maintain his level of performance in an other than a one-to-one situation remains his most serious problem. The transition from dependent to independent behavior requires considerably more programming.

Achievement in Academic Skills

Reading. S.W. finished the Individualized Reading Program based on 270 words. He then continued to work in the Bank Street Readers and in reading books of his own. He learns new words quickly but must usually be told what they are since he has acquired few phonic skills. He has some difficulty in understanding directions in workbooks, although other types of comprehension are good. He does not work independently.

Arithmetic. S.W. is able to match numbers and sets; count by 1's to 50, and by 5's and 10's to 100; read and write the numbers 1-20; and do simple addition, using finger counting with some prompting.

Writing. S.W. can print letters, words, and phrases. The letters are not consistently well formed, and there is some confusion between capital and lower case letters. He has cursive writing skills, but requires a model and prompting to form letters correctly.

Spelling. S.W. can spell 130 words from the Individualized Reading Program. He takes about two weeks to learn 10 words perfectly. He works independently in spelling taking tests on the Language Master.

Use of creative materials. S.W. is creative and verbal. The opportunity to draw a picture or make up a story can serve as an effective reinforcer. He uses all of the art materials available and is quite independent in art work.

Achievements in Personal and Social Skills

Self-help skills. Though S.W. shows very little independence in academic work, he is quite independent in terms of locomotion and self-help skills (dressing, undressing, washing hands, etc.).

Social skills. S.W. now shows few manneristic behaviors in school. He plays well with other children, though his activity is necessarily somewhat restricted by his crutches. His conversational skills are more than adequate and his sense of humor is much more sophisticated than that of his peers. He shows none of the social withdrawal that characterizes the "autistic" child.

Future Educational Plans

S.W. will attend a small class for the educably mentally retarded, principally because such placement will provide for a continued implementation of the techniques which have been successful in the Laboratory class. There has been communication and cooperation between S.W.'s Laboratory class teacher and his teacher-to-be with regard to problem areas, existing behavioral repertories, effective procedures, and optimal planning. Hopefully, someone will be available to work with the foster-mother on behavior modification in the home, since many of the problems virtually eliminated in the school setting, notably the boy's mannerisms, are in frequent evidence in the home situation.